

The background of the entire cover is black. It is filled with a dense, chaotic web of thin, white, hand-drawn lines that swirl and loop across the frame. In the lower-left quadrant, there is a more concentrated and thicker cluster of yellow lines, also swirling and looping, which contrasts with the white lines and the black background.

# **CHAOS IMAGINED**

*LITERATURE  
ART  
SCIENCE*

**MARTIN MEISEL**

# CHAOS IMAGINED



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*LITERATURE,  
ART,  
SCIENCE*

**MARTIN MEISEL**

*COLUMBIA UNIVERSITY PRESS NEW YORK*





Columbia University Press

Publishers Since 1893

New York Chichester, West Sussex

[cup.columbia.edu](http://cup.columbia.edu)

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E-ISBN 978-0-231-54046-9

Library of Congress Cataloging-in-Publication Data

Meisel, Martin.

Chaos imagined : literature, art, science / Martin Meisel.

pages cm

Includes bibliographical references and index.

ISBN 978-0-231-16632-4 (cloth : acid-free paper) — ISBN 978-0-231-54046-9 (e-book)

1. Literature and society. 2. Chaotic behavior in systems—Social aspects. 3. Arts and society. 4. Social change. 5.

Chaotic behavior in systems in literature. 6. Literature and science. 7. Entropy in literature. I. Title.

PN45.M433 2015

801—dc23

2015010548

A Columbia University Press E-book.

CUP would be pleased to hear about your reading experience with this e-book at [cup-ebook@columbia.edu](mailto:cup-ebook@columbia.edu).

Cover design: Lisa Hamm

Cover image: © plainpicture / Hanka Steidle

Frontispiece. From an intarsia designed by Lorenzo Lotto and executed by Giovanni Francesco Capoferri, ca. 1527, Basilica of Santa Maria Maggiore, Bergamo, Italy. See my exegesis in the notes section.

References to websites (URLs) were accurate at the time of writing. Neither the author nor Columbia University Press is responsible for URLs that may have expired or changed since the manuscript was prepared.

To Frederick Laurence Meisel, il miglior fratello,  
and Lili Ann Meisel,  
with love



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# ACKNOWLEDGMENTS

**C**haos Imagined has been on the stocks for more than a quarter of a century. I once told my wife, Martha, somewhat ruefully, “It will last my time”; alas, it outlasted hers. She, with patience, humor, and a taste for the unorthodox, helped it on its way, along with many others. How could it be otherwise, with so vast and unconfined a subject? One that trespasses on so many posted territories where I have no license to hunt? In the long list of those to whom I am indebted are a number of institutions and organizations, notably the National Humanities Center in North Carolina, where the work began; the Woodrow Wilson International Center for Scholars in Washington, where it continued; the John Simon Guggenheim Foundation; and Columbia University, with its rich mix of disciplines and forums and its tolerant encouragement of teaching and thinking outside and across the established lines. One such forum was Columbia’s University Seminars, and I may now happily express my appreciation to the Seminars’ Schoff Fund for its help in publication. Material in this book was first presented in the Frank Tannenbaum Lecture to the Fifty-Fourth Annual Meeting of the University Seminars and benefited from discussion there and in the seminar *Drama: Text and Performance*.

As a work in progress, the manuscript was read in whole or part by a number of friendly critics, and others provided expert advice on particular matters. I am especially grateful for the generous efforts and commentary of Christine Gledhill, David J. Helfand, Jean Howard, Robert G. Hunter, the late Karl Kroeber, Marjorie Perloff, James Shapiro, and Alex Zwerdling, all of whom took time from their own fruitful labors to scrutinize mine, and to others who provided free consultation or much needed reassurance, such as Helene Foley, Jan-Piet Knijff, the late David Rosand, Barrymore Laurence Scherer. I am grateful to Nimet Habachy for insights into the social and performative aspects of musical culture and for her sustaining warmth and enthusiasm. Several anonymous readers for the press helped shape the final form of this book in qualifying their otherwise encouraging readings. Through much of its prolonged gestation, I have taken advantage of the acumen and expertise of my three children: Maude Frances Meisel, especially for matters Russian, literary, and stylistic; Andrew A. W. Meisel, for matters scientific, philosophic, and linguistic; and Joseph Stoddard Meisel, with his informed and rigorous eye in matters historical. Naturally, none felt obliged to stay within those confines.

At the Columbia University Press, Jennifer Crewe has my particular gratitude for wanting to take on such a book in the first place. Among those who have helped navigate the process and make it enjoyable are Michael Haskell, Marisa Pagano, Kathryn Schell, Lisa Hamm as designer, and Rob Fellman as copyeditor. Several generations of remarkable students, in class and out, have also left their traces in the book, as in my thinking. Among those who made a direct contribution, in pursuing a topic or a body of material, are John Bell, Bianca Calabresi, Tamsen Wolff, Alexis Soloski.

A version of part of [chapter 7](#), on the argument over the age of the earth and the death

of the universe, was published online by BRANCH: Britain, Representation, and Nineteenth-Century History, [http://www.branchcollective.org/?ps\\_articles](http://www.branchcollective.org/?ps_articles). Lines from the poem by Wallace Stevens, "Connoisseur of Chaos," from *The Collected Poems of Wallace Stevens*, copyright © 1954 by Wallace Stevens and copyright renewed 1982 by Holly Stevens, are used by permission of Alfred A. Knopf, an imprint of the Knopf Doubleday Publishing Group, a division of Penguin Random House LLC, all rights reserved. Lines from the poem by Howard Nemerov, "Angel and Stone," appear courtesy of the Estate of Howard Nemerov. This book is dedicated to my brother, Frederik Meisel, a gifted psychiatrist and psychoanalyst, and his wife Lili, costume designer and fabricator among other things, in gratitude for our lifelong friendship.

# UNCERTAINTY AND COMPLEXITY

## AN UNTETHERED EPILOGUE

The curtain rises. The theater represents a theater.

**THE EPILOGUE** comes forward.

**EPILOGUE:** Now, [ladies and] gentlemen, how did you like our play?

—Ludwig Tieck, *The Topsy-Turvy World* (1798)

When he began his wildly satirical metaplay of nested theaters-in-the-theater with an epilogue, dismissing the play that follows as a mere formality, Ludwig Tieck was after a provocative bit of estrangement. Inevitably, he ends the performance with a prologue, alerting the audience to what it is supposedly about to see and incidentally completing the well-worn carnival strategy of inversion for enacting the temporary reign of chaos. I too begin with an epilogue, properly capping a historical and thematic exploration of how artists, poets, philosophers, and scientists have attempted to give shape to the imagination of chaos, in the hope that in bringing it forward, I will in effect be bringing it home.

At the very time Tieck was perpetrating his pastiche of burlesque and philosophy—a time of great social and political turmoil—a revolution was also brewing in science that would profoundly transform the imagination of chaos. For with the generalization of energy and later of entropy, the twin pillars of the new science of heat, new channels of thought and feeling came into force, changing the face of order and disorder, cosmos and chaos, in human perception and understanding. The revolution wrought by energy took place as well in the realm of values, notably in attitudes toward disruptive change. That wrought by entropy was, conceptually at least, even more disconcerting for traditional thinkers, in its radical contrast with the enduring notion of chaos as energetic turmoil. The alternative, by way of what came to be called the second law of thermodynamics, pointed to a wholly other kind of chaos as a final condition: a depleted, undifferentiated, exhausted sameness, a universal undoing, the heat death of everything, where everything—as Clov puts it in Beckett’s *Endgame*—is “corpsed.”

By the end of the twentieth century, knowledge of the second law of thermodynamics, C. P. Snow’s touchstone for the divide between “the two cultures,” had not exactly dropped out of contemporary physics education, but thermodynamics had certainly lost out in competing for attention as a road to fresh discoveries. It retained a place in introductions to mechanics and statistical physics, but in 1973, Werner Heisenberg, one of the boldest demolition artists in the refounding of modern physics, could remark, “I am rather convinced that such a field as elementary particle physics can come to a close like thermodynamics,

or like optical atomic spectra, which has come to a close.”<sup>1</sup> Prophecy in general is like a bet against the house, and Heisenberg’s crystal ball was certainly clouded on the closure of particle physics. But he had better luck with thermodynamics, considered as a well-defined territory with an advancing theoretical frontier. Indeed, it can be argued that, apart from numerous useful applications, an appearance of maturity in the field gave way to something closer to senescence, as interest in phenomena and forces macrocosmic and microcosmic, virtual and actual, on scales heretofore unimagined, left it by the wayside.

Thermodynamics has recently found new life in the embrace of such hybrid fields as “thermoeconomics” and “biophysical economics,” and “entropy” has remained a powerful trope, informing some of the most compelling literary fictions produced during the PTSD intervals of the twentieth century. But even where entropy was imagined as the bleak road to chaos, it still rested on a paradigm in whose origins there was no serious threat to the idea of a universe of laws, laws that in some grimly reassuring way constituted a foundational metacosmos. Even the paradox of a terminal chaos exhibiting the characteristics of a terminal order, a chaos achieved through loss of complexity and the annulling of difference, a cosmos forever unwound or forever unwinding, perpetuates the inexorable authority, coherence, and universality of the second law and the chartered foundations. But times have changed. More recently we appear to have entered a conceptual regime where the foundational metacosmos has been shaken and split and where chaos and cosmos no longer have the same authority as useful categories and imaginative antinomies. They are no longer distinct and distinguishing, that is, when attached to what we still call reality in spite of assorted challenges to the belief that something deserving that name is known to us.

The two powerful currents in the imagination of chaos in our own time are, first, the problematizing of knowledge and its foundations, most critically scientific knowledge, and, second, the robust co-option of features long associated with chaos, including its very name, into a more encompassing account of the world and the universe we live in. The former is the foundational challenge, seemingly circumscribing, deracinating, and contaminating (in a kind of transgressive mingling of observer and observed) the instruments of systematic ordering and explanation. It can be profoundly disconcerting to minds and sensibilities that want something solid underfoot. It is the whiff of a chaos whose most famous rejectionist was probably the later Albert Einstein. It is where we shall begin.

## AFTER ENTROPY

It cannot be too emphatically repeated that blind chaos and arbitrary disorder constitute the philosophy of fools; and that they are the bane of natural knowledge, philosophy, and religion.

—J. C. Lavater, *Essays on Physiognomy*, 1775–1778

Questioning whether we live in a universe of laws is no new thing. It is the issue, for example, in Sophocles’ *Oedipus Tyrannus*, and it lies implicit in almost any attempt via myth or metaphysics to rationalize the existence of injustice and irreducible disorder. But with the scientific revolution—however halting and heterogeneous its origins and pursuits—and the



successively refined codification of scientific method, there grew up a secure, confident realm seemingly not dependent on faith or revelation, accessible to reason and reasoning, to experimental verification, and amenable to compelling generalization in a language universal and exact, the language of mathematics. As it took hold, the great scientific enterprise of progressively uncovering the laws of nature—optimistically extended to the laws of society, of political economy, of character and behavior—successfully shed its initial justification as furthering the argument from design and took on foundational attributes of its own. A foundation in the divine—for all the contortions of rational theodicy—still rested on faith in God’s sustaining will and often inscrutable purposes. A foundation in “natural philosophy”—soon to foster an exclusive etymological claim to true knowledge under the rubric “science”—squeezed faith out of its heuristics, in program and method. Indeed, it characteristically saw itself as uncovering and enlarging the reality of a universe of laws through a rigorous applied skepticism.

Testable, verifiable, and universalizing generalizations about the nature of things—such generalizations at their most powerful and fundamental crowned as “laws”—took on immense glamour and authority in science with Newton, and they enjoyed a sustained forward impetus whose present expression and ultimate goal lies in the aggressively titled “theory of everything.” In the last century, it took the form of Einstein’s quest for a unified field theory, and earlier yet—before the relativizing of space and time—it crystallized in the visionary declaration of the great French Newtonian Pierre Simon de Laplace (1814):

An intelligence which knows the forces acting in nature at a given instant, and the mutual positions of the natural bodies upon which they act, could, if it were furthermore sufficiently powerful to subject these data to mathematical analysis, condense into a single equation the motion of the largest heavenly bodies and of the lightest atoms; nothing would be uncertain for it, and the future as well as the past would lie open before its eyes. The human mind, in the perfection to which it has carried astronomy, offers a weak image of such an intelligence in a limited field.<sup>2</sup>

Whatever its practicality, such a supergeneralization as a framework principle, with its intrinsic positive bent, seems to require something that is very like faith after all—the faith in perspicuous rationality and predictability that Einstein famously rendered in shorthand as God not playing dice with the universe.<sup>3</sup> For two centuries and perhaps more, mainstream science and the broad popular views derived from it could operate without giving much heed to its assumptions about a metacosmos, a foundation underlying its elaborations of order in the physical universe in which effect follows cause, identity and difference are mutually exclusive, a law somewhere is a law everywhere, and the instruments of knowing are a match for whatever there is to be known. On those assumptions, all one had to do was look hard enough, think originally and deeply enough, and new truths and beauties would be unveiled.

For key sectors of science and for the intellectual climate in which they operate, both the security and the adequacy of those taken-for-granted foundations have been shaken. Nothing has happened to discourage the scientific enterprise itself or its deep attachment to cosmos. But that attachment depends—as it must always have done—on a deeply intuitive aesthetic feeling, “an emotion I have about the beauty of the world,” in the words of Richard Feynman, one of the most unpredictably creative scientists and teachers of the last half-century, a scientific rapture “analogous to the feeling one has in religion that has to do with

a god that controls everything in the whole universe.” He continues:

There’s a generality aspect that you feel when you think about how things that appear so different and behave so differently are all run “behind the scenes” by the same organization, the same physical laws. It’s an appreciation of the mathematical beauty of nature, of how she works inside; a realization that the phenomena we see result from the complexity of the inner workings between atoms; a feeling of how dramatic and wonderful it is. It’s a feeling of awe—of scientific awe—which I felt could be communicated...to someone who had also had this emotion. It could remind him, for a moment, of this feeling about the glories of the universe.<sup>4</sup>

In contrast are the sometimes poignant expressions of unease among scientists and mathematicians filtering into the currents of scientific thought. These have to do, in the broadest terms, with the very notion of scientific laws or, more specifically, with their competence as generalizations, with their consistency and completeness as the foundations of basic disciplines, with the sustainability of the claims of science to objectivity and precision, claims so integral to its morale and identity.

As some of the implications of the quantum revolution unfolded, transforming our understanding of light and matter—of reality, in short—some of its founders, Max Planck as well as Albert Einstein, grew uneasy. But the trouble started earlier, in nineteenth-century thermodynamics, with a shift in the modeling of entropy—mechanical energy transformed and dissipated as heat—from a conceptualization rooted in continuous flow, as in the obsolete notion of a fluid “caloric,” to a description more appropriate to the behavior of energized particles in a constant and varied interaction impossible to measure or track. Redefined statistically, the model for entropy was no longer the one-way flow and dispersal from warm to cold so familiar in our experience but the overall tendency of things to go from less probable to more probable states. Nor was it then as absolute as “the second law” implies. Oswald Spengler, as we will see, took this presumptive acceptance of an elemental disorder and of the necessity of relying on a “calculus of probabilities” as symptomatic of the West’s immanent cultural decline. Meanwhile, in the related critical matter of Brownian motion (dust motes and microscopic particles agitated by the random impulses of gaseous or liquid molecules), Einstein’s masterful effort to rescue classical causality from the jaws of accident brought about—at least according to Paul Feyerabend, that radical critic of abstraction masking as physical law—the second law’s actual (if indirect) refutation.<sup>5</sup>

A darker suggestion lies behind the uneasy statement in Norbert Wiener’s popular annunciation of the age of cybernetics, *The Human Use of Human Beings*. Discerning in the stochastic turn “recognition of an element of incomplete determinism...almost an irrationality in the world,” he goes on to say: “For this random element, this organic incompleteness, is one which, without too violent a figure of speech we may consider evil; the negative evil which St. Augustine characterizes as incompleteness, rather than the positive malicious evil of the Manicheans.” In fact, it is this very incompleteness distended into nothing that the saint characterizes as “Chaos.”<sup>6</sup>

The competence of scientific law as generalization has in recent years been subject to external attack, in critiques invoking a relativism grounded in psychology, class interests, social conditioning, gender difference, and historical circumstances. Science, like art, social arrangements, and personal and group identity, is in this reading first of all a cultural

construct, and its most confident assertions are thus essentially arbitrary. But such skepticism toward scientific claims of objectivity skirts the much more interesting challenges generated from within science and encompassing both theory and practice. One set of these challenges finds modern expression in related concerns with predictability, causality, and mensuration. But it has an earlier history, shaped by Locke and Hume in the seventeenth and eighteenth centuries, surfacing in the phenomenalist empiricism of Ernst Mach near the turn of the twentieth century and in the nearly contemporary heretical challenge of a young and brash H. G. Wells not yet the utopian advocate for the institutional authority of an enlightened scientific elite.

In 1891, with his science training behind him, the twenty-four-year-old Wells published, in the prestigious *Fortnightly Review*, an essay called “The Rediscovery of the Unique,” which calls into question the foundations of the discipline he was now teaching. Four decades later, in his *Experiment in Autobiography*, Wells recalled his early essay while engaging Max Planck’s recent *Where Is Science Going?* (1932). Planck, says Wells, abetted by Einstein, argues that “ultimately fine measurements and closer analysis will eliminate that quality of undeterminateness” that seems to compromise strict causality. “But will they?” Wells asks, and he cites his prescient youthful critique.<sup>7</sup>

As a student at the Normal School, later the Royal College of Science at South Kensington, at a time when, he reports, “the science of physics was in a state of confusion and reconstruction,” Wells had found himself bored and alienated by the formal instruction in that discipline and by what he perceived as its idealizing abstraction.<sup>8</sup> In “The Rediscovery of the Unique”—after some youthful, ironic hyperbole on the importance of what he is about to say—he states his discovery: “All being is unique, or nothing is strictly like anything else. It implies, therefore, that we only arrive at the idea of similar beings by an unconscious or deliberate disregard of an infinity of small differences.”<sup>9</sup> He applies this insight not only to language, pointing out the arbitrariness of the common noun as a blanket term, but to number: “number is a purely subjective and illusory reduplication of uniques.” He takes from geology and evolutionary biology the notion “that everything passes into everything else by ‘insensible gradations’”—thus undercutting all classificatory terms and fixed taxonomies. As for “this human delusion of number,” he roundly declares, “When we teach a child to count [and thus to discount differences], we poison its mind almost irrevocably.” Neither celestial mechanics nor the atomic theory of the day escape his phenomenalist critique, and “similarly the certainty of all the so-called laws of physics and chemistry is now assailable” (108–109). He points out that in scientific practice, the scientist, knowing the shakiness of any assumption of uniformity in entities and conditions, resorts to statistics—“averages”—and that “the chemist,” allowed to hedge probative experiment with an “unreasonable width of ‘margin of experimental error’...gets results most satisfactory to himself by taking large quantities and neglecting fractions” (109–110).

Speaking as Huxley’s ardent evolutionist disciple, Wells further declares: “The work of Darwin and Wallace was the clear assertion of the uniqueness of living things,” and the physicists and chemists are now trying, “in a hesitating way,” to catch up (111). Wells, the original angry young man, at odds with the whole Victorian order, extends the application of his essential *aperçu* to morality: “beings are unique, circumstances are unique, and...

therefore we cannot think of regulating our conduct by wholesale dicta”—what are called “principles” (110). Finally (or nearly so), to give articulate form to his underlying positive vision, he reaches for an earlier poet-scientist’s metaphor, one that he believes speaks far more truly to “the fathomlessness of the unique mystery of life”:

The figure of a roaring loom with unique threads flying and interweaving beyond all human following, working out a pattern beyond all human interpretation, we owe to Goethe, the intellectual father of the nineteenth century. Number—Order, seems now the least law in the universe; in the days of our great-grandfathers it was heaven’s first law.<sup>10</sup>

The later, more tentative, autobiographic Wells still finds himself perturbed by the disjunction between the common language, rooted in experience, and the riddling opacities of high scientific generalization. And while he grants that, to a mind shaped by experience, “the more similar the cause the more similar the effect,” yet “there never has been, it seems, exactly the same cause and exactly the same effect.” As for quantum reality and the issues it raises with respect to strict causation, “we may so far agree with Max Planck as to believe that we shall continually approximate to it with increased precision of observation and analysis. But also we may add a conviction that we shall never get to it. We shall never get to it for the excellent reason that there is not the slightest justification, outside the presumptions of our own brains, to believe that it is really there.”<sup>11</sup>

One might be tempted to dismiss Wells’s challenge as an interesting curiosity, despite his training and intelligence; it is the buzzing of a gadfly outsider—and a novelist at that. But in 1955, the physicist Max Born presented a paper asking, “Is Classical Mechanics in Fact Deterministic?”<sup>12</sup> He there argued that the probabilistic basis of quantum mechanics, requiring statistical statements, applies as well to phenomena that are amenable to the laws of classical mechanics. That is, it applies to the real world of our experience in principle and not just as a matter of coming to terms with technical limitations. He emphasizes that there is no such thing as absolute or infinitely precise measurement and that the smallest difference, or deviation, or imprecision in measuring a molecular trajectory, for example, will result in large differences and multiplied divergences from the initial prediction (165–166). The notion from weather science that later entered popular consciousness as the “butterfly effect” here appears in less picturesque guise. Born had made the same point the year before, in his Nobel Prize lecture. There, while retracing the history of mechanical determinism in the wake of Newton, Born identified its fatal flaw: the necessary—meaning unavoidable in principle—inaccuracy or incompleteness of measurement, for which he used the example of  $\pi$ .<sup>13</sup>

## INCOMPLETENESS AND INCONGRUITY

“By the end of the [twentieth] century they will have to admit that the laws they are supposed to have discovered seem to act in a profoundly disorderly way. What is a disorderly law, Fairly?”

“It sounds like chaos,” said Fred.

“The chaos will be in their minds only. It, too, will not be observable.”

—Penelope Fitzgerald, *The Gate of Angels*



The issue of “completeness,” linked to that of internal consistency and to consistency and continuity across disciplines, offered another challenge to the assumptions that formed a metacosmos.<sup>14</sup> “The fact that in an exact science like physics there are found mutually exclusive and complementary situations that cannot be described by the same concepts but need two kinds of expressions, can be applied to other fields of human activity and thought,” wrote the physicist Max Born, taking heart from that common condition.<sup>15</sup> But such discontinuity between discourses in a discipline is not equally damaging when it occurs, say, in literary criticism or even geography. In fact, such differences can be refreshing, stimulating new approaches, fresh angles, supplying a new fund of interpretive metaphor. But in an “exact science” (physics, chemistry) where description takes aim at the underpinnings of everything—and in mathematics, where universality and self-consistency are everything—incompleteness and disjunctive inconsistency can be felt as devaluing and demoralizing, if not an offence against the gods. Thus, as the biological sciences more and more engage the molecular underpinnings of life and more and more take on the mantle of “exact” sciences, they too become subject to ruminations like that of the biologist John Dupré on *The Disorder of Things: Metaphysical Foundations of the Disunity of Science*.<sup>16</sup>

As for mathematics, here is how the distinguished practitioner Morris Kline begins his book-long lament, *Mathematics: The Loss of Certainty*:

There are tragedies caused by war, famine, and pestilence. But there are also intellectual tragedies caused by limitations of the human mind. This book relates the calamities that have befallen man’s most effective and unparalleled accomplishment, his most persistent and profound effort to utilize human reason—mathematics.<sup>17</sup>

The tragedy of mathematics in Kline’s account is twofold. The first part has to do with the “reality” of mathematics, its lost ties to the phenomenal world. Before the Fall (does every discipline recall a lost paradise?) there was no contradiction between the truth value of mathematics and its integrity as a self-referential, self-consistent system distinguished by its systematic rigor. Mathematical concepts and derivations supplied the backbone of scientific theory, and “the predictions in the mathematical theories of astronomy, mechanics, optics, and hydrodynamics were in remarkably accurate accord with observation and experiment. Mathematics, then, provided a firm grip on the workings of nature, an understanding which dissolved mystery and replaced it by law and order” (3). But that unity was lost as “pure” mathematics turned freely inventive and solipsistic, and then, in the second part of the tragedy, even its self-consistency was fatally challenged. “Completeness,” as Kline explains it, means “that the axioms of any branch [of mathematics] are adequate to establish the correctness or falsity of any meaningful assertion that involves the concepts of that branch” (258). By the 1930s, not only had Henri Poincaré shaken complacency by proving that certain classes of problems were intrinsically insoluble, but Kurt Gödel had advanced his “incompleteness theorem,” stating that if any formal theory adequate to embrace the theory of whole numbers is consistent, then it is necessarily incomplete. “Apparently the price of consistency is incompleteness” (265). And apparently, for some minds at least, discovering such a disjunction, problematizing the very foundations of mathematics as a self-consistent body of theory and practice, richly tautological (its purest expression the equation), was like drawing back the curtain to

expose the claptrap machinery of the Wizard of Oz. Robbed of security as to its own foundations, mathematics fell vulnerable to Einstein's bemused aphorism, "As far as the laws of mathematics refer to reality, they are not certain, and as far as they are certain, they do not refer to reality."<sup>18</sup>

Physics, the wunderkind science of the twentieth century, is undoubtedly the primary exhibit. Wells thought the science was in a state of confusion and reconstruction in the 1880s, which is perhaps another way of saying that it was on the brink of staggering achievements. Nevertheless, now in the wake of that achievement, we are left with a seemingly intractable disjunction between gravitational theory (relativity) and quantum mechanics, a disjunction inspiring successive waves of theoretical pyrotechnics that have become, it would appear, increasingly untestable and bizarre. Moreover, each of these fundamental realms in physics is, in the language of the science writer George Musser, in itself incomplete. Relativity theory falls short in its ability to deal with black holes and with what happens at what is called the "event horizon," and, Musser writes, "As Einstein was the first to realize, quantum mechanics, too, is incomplete. It offers no reason for why individual physical events happen, provides no way to get at objects' intrinsic properties and has no compelling conceptual foundations."<sup>19</sup> Indeed, in the phrasing of Werner Heisenberg, a primary architect of the still dominant discourse concerning the quantum world, "the incomplete knowledge of a system must be an essential part of every formulation in quantum theory."<sup>20</sup>

The foundational challenge in quantum theory is presented as a matter of urgency—in the face of a results-oriented complacency—by the quantum theorist Anton Zeilinger. Citing predecessors like John Wheeler (in the resoundingly titled "Law Without Law"),<sup>21</sup> John Bell ("Against Measurement"),<sup>22</sup> and Wolfgang Pauli (securely in the pantheon of the great contributors to the theory's development), Zeilinger argues that quantum mechanics lacks an "epistemological paradigm on which we could build a foundation.... If this is true then quantum mechanics, which undoubtedly is correct as it supplies correct predictions, hangs in the air quasi in a state of suspense as far as its paradigmatic foundation is concerned."<sup>23</sup> Bell, he notes, pointed out that there is no way in quantum mechanics to "explain why (specific) events happen." Wheeler resorts to regarding quantum phenomena that elude determinate predictability as elementary acts of creation. And Pauli, growing desperate, adds to refined scholastic distinctions the prescientific notion of an *anima mundi* and then qualifies it with opera: "*La donna é mobile*."<sup>24</sup>

Zeilinger declares, "The discovery that individual events are irreducibly random is one of the most significant findings of the twentieth century." What he calls "the message of the quantum" takes it a step further: "But for the individual event in quantum physics, not only do we not know the cause, there is no cause.... There is nothing in the Universe that determines the way an individual event will happen. Since individual events may very well have macroscopic consequences, including a specific mutation in our genetic code, the Universe is fundamentally unpredictable and open, not causally closed."<sup>25</sup> As for science itself, "I propose that this impossibility to describe the random individual process within quantum mechanics in a complete way is a fundamental limitation of the program of modern science to arrive at a description of the world in every detail. In other words, I propose that

this is evidence of an element in the description of nature which escapes rational dissection in detail into constituent parts.”<sup>26</sup>

The acknowledgment of limitation as “fundamental” is significant. A recurrent theme in modern science—after a brace of centuries where the human capacity to know and understand seemed open-ended—has been a collision with the limits of knowledge. Not that our collective minds could not go on forever finding out new things about the universe and ourselves. But also, it appears, there are some things we simply can’t know, or know in the way we would like to, because of features inherent both in the structure of knowledge and in what is out there to be known. As John Horgan observed while reporting on a symposium on the limits of scientific knowledge: “For three days, a score of scientists, mathematicians and philosophers debated whether it might be possible for science to know what it cannot know. After all, many of the most profound achievements of 20th-century science—the theory of relativity, quantum mechanics, Gödel’s theorem, chaos theory—prescribe the limits of knowledge.”<sup>27</sup>

Much of the residue, or what lies beyond the limits, everything that appears intrinsically unknowable or unfathomable, irreconcilable or insoluble, constitutes the last unplumbed reserve of chaos.

## THE MESSAGE OF THE QUANTUM

Objective limits on knowledge remain easier to understand and perhaps easier to accept than those that are cognitive and epistemic, those that involve the subject. Poincaré’s proof that the three-body problem, so pertinent to the predictability of Newton’s universe, is insoluble is an exemplifying case of the former, and the inadequacies of mensuration of the kind so evident to Wells and Born—no matter how sensitive the instrument—also fill the bill, as does what is known as the “cosmic horizon,” of which more below. The cognitive or epistemic limits come fully into play with the development of quantum theory, though there were unsettling features involving the observer in relativity theory also, in its overthrow of the notion of absolute space and time. A longstanding intellectual program to anathematize subjective influence in law and life, but especially in science, effectively guaranteed a severe shock to sensibilities wedded to uncompromising standards of objectivity. That program was articulated compellingly in Francis Bacon’s *Novum Organum* (1620), the text that served as an inspiration to what came to be called the scientific method and to the founding of the Royal Society. In laying out the obstacles to be overcome, Bacon famously cites the Idols of the Cave, where “each has a cave or den of his own, which reflects and discolours the light of nature.” But even more pertinent, because less eccentric and more difficult to evade, are what he calls the Idols of the Tribe:

The Idols of the Tribe have their foundation in human nature itself and in the tribe or race of men. For it is a false assertion that the sense of man is the measure of all things. On the contrary, all perceptions as well of the sense as of the mind are according to the measure of the individual and not according to the measure of the universe. And the human understanding is like a false mirror, which, receiving rays irregularly, distorts and discolours the nature of things by mingling its own nature with it.<sup>28</sup>

Bacon's aim is iconoclastic. In contrast, the most widely accepted account of quantum mechanics and quantum reality—if such a term is not missing the point—the so-called Copenhagen interpretation, rested on the unavoidable conclusion that the mirror's "mingling of its own nature" with the rays it receives is intrinsic to the process that engages the phenomena, and consequently to the phenomena themselves, and not something to be eliminated or discounted. Chiefly responsible for what became the Copenhagen interpretation were Niels Bohr and the aforementioned Werner Heisenberg, the brilliant formulator of the uncertainty principle (1927) and the quantum theorist who most readily embraced philosophic idealism in his account of reality. In Heisenberg's summation, the revolutionary change in modern science, a final consequence of where it has led, is that "the natural laws formulated mathematically in quantum theory no longer deal with the elemental particles themselves but with our knowledge of them."<sup>29</sup> What that means is that "the old division of the world into objective processes in space and time and the mind in which these processes are mirrored—in other words, the Cartesian difference between *res cogitans* and *res extensa*—is no longer a suitable starting point for our understanding of modern science." Science, he argues, no longer stands in the position of an objective observer "but sees itself as an actor in this interplay between man and nature." The scientific method "has become conscious of its limitations, which arise out of the fact that by its interventions science alters and refashions the object of investigation. In other words, method and object can no longer be separated. The scientific world-view has ceased to be a scientific view in the true sense of the word."<sup>30</sup>

Heisenberg means something more basic than that scientific advances and man's interventions change the condition of the natural world. He is saying that at a fundamental level, notably where the quantum regime is manifest, any attempt to probe its condition with any imaginable instrument (i.e., extensions of our perceptual apparatus) will affect what there is to be known. Further, in the specific case of the location and motion of any elemental particle, the more precise one manages to be about the one the less precise one can be about the other—though one can give a very good account of both together. Initially a prediction of the theory, quantum uncertainty has proven itself in application, sometimes in startling form, as when normally invisible atoms are stilled to near motionlessness, or absolute zero, and "position" expands into a giant presence, a blur of sustained probability and a melding of distinct identities.<sup>31</sup>

The observer and the act of observation are implicated in myriad other expressions of quantum reality, along with the instruments of observation that connect them, so that, in Heisenberg's striking phrase, "we discover that we no longer correlate objective processes in space and time, but only observational situations."<sup>32</sup> Oddly, as initially in the case of light, which tests as both wave and particle, it is the instrument one brings to bear, the question one asks of the phenomena, and the act of observation itself that seem to determine reality.<sup>33</sup> In a brief overview on the centenary of Max Planck's desperate attempt to explain a set of puzzling results by postulating that emitted energy came only in packets of a standard size (quanta), the science writer Dennis Overbye sums up the ensuing revolution as "a bizarre set of rules known as quantum mechanics, in which causes were not guaranteed to be linked to effects; a subatomic particle like the electron could be in two



places at once, everywhere or nowhere until someone measured it; and light could be a wave or a particle.”<sup>34</sup> In his intricate espionage play *Hapgood* (1988), where the human agents behave, for all their middling size, like the creatures of a quantum universe, Tom Stoppard has his triple-turned Russian physicist explain further:

The particle world is the dream world of the intelligence officer. An electron can be here or there at the same moment. You can choose. It can go from here to there without going in between; it can pass through two doors at the same time, or from one door to another by a path which is there for all to see until someone looks, and then the act of looking has made it take a different path. Its movements cannot be anticipated because it has no reasons. It defeats surveillance because when you know what it's doing you can't be certain where it is, and when you know where it is you can't be certain what it's doing: Heisenberg's uncertainty principle; and this is not because you're not looking carefully enough, it is because there is no such thing as an electron with a definite position and a definite momentum; you fix one, you lose the other, and it's all done without tricks, it's the real world, it is awake.<sup>35</sup>

Real perhaps, but nevertheless unimaginable. As Richard Feynman tells us, electrons and light “behave in a way that is like nothing that you have seen before. Your experience with things that you have seen before is incomplete. The behavior of things on a very small scale is simply different.” It opens a yawning gap between knowledge and understanding. “Now we know,” says Feynman, “how the electrons and light behave.” But he adds, “There was a time when the newspapers said that only twelve men understood the theory of relativity. I do not believe there ever was such a time.... A lot of people understood the theory of relativity in some way or other, certainly more than twelve. On the other hand, I think I can safely say that nobody understands quantum mechanics.”<sup>36</sup>

Niels Bohr subscribed to the necessity of finding in common language (not equations and derivations) a vehicle of expression for the concepts that seemed so in conflict with common experience and its logic yet were so powerful in plumbing the nature of things. Nevertheless, Bohr also insisted that physics was not about things as such, phenomena that can be visualized, but about concepts applied in experiments. Freed from the burden of visualization, he found in language the means to turn contradiction into “complementarity,” explain alternative ways of being as a “superposition.”<sup>37</sup> Indeed, “complementarity”—that is, unresolved alterity—became for him a unifying principle, drawing into a common frame all the arts and sciences. (Michael Frayn makes real that commonality in *Copenhagen* [1998], his gripping play about Bohr, Heisenberg, and alternative realities.)<sup>38</sup> Other quantum bizarrenesses, such as “entanglement,” initially advanced to demonstrate an absurdity, also turn out to have some experimental validity. Derived by Einstein and his collaborators from quantum mechanics, entanglement predicts that an intervention affecting a particle in one place will instantaneously affect its twin at a vast distance, like a quantum version of Dumas' famous tale of the Corsican brothers.<sup>39</sup> With all this, the continuing discomfort in physical science is not about quantum operations but about attempts to elevate these into a theory of reality. So direct a critic as the astrophysicist Peter Coles marvels at the success of the Copenhagen interpretation's mystifications among normally intelligent people. He has even less time for its off-the-wall offspring, like the alternative (branching) universe solution to the Copenhagen idea that an act of measurement precipitates a “probability wave” or wave function into one or another actual physical state (as in the famous case of Schrödinger's cat). It is to confuse states of knowledge with states of being, he argues,

thanks to the papering over of a theory that remains incomplete.<sup>40</sup> Nevertheless, given all that we do know—and know about what we don't and can't know—putting one's money on science coming to its senses and one day arriving back in the comfortable classical universe would undoubtedly be a very bad bet.

## LOST HORIZONS

If there are voices in science uneasy, indeed impatient, with attempts to extrapolate a theory of reality from where the science leads, there is a good case to be made against abdicating the responsibility for pursuing such a theory. One of its plausible foundations would concern beginnings. In 1927 Paul Dirac, for a time part of the circle around Bohr, postulated the existence of antimatter and then, dispensing with the conservation principle for the particle, cleared the way for a universe in which space, far from being empty, is host to the spontaneous appearance and instant annihilation of myriads of virtual particles of opposite charge, uncaused and unpredictable. Such a chaos of randomized flux, the ground against which the constellated cosmos figures, also may be what provides the enabling condition for the most consequential spontaneous event of all, the conjectural primal vacuum fluctuation that set off the Big Bang.<sup>41</sup>

The theory of the inflationary universe, which followed from the evidence of a starting point in the Big Bang augmented by evidence of a now accelerating expansion of the universe as a whole, displaced competing “steady-state” models, though perhaps not permanently.<sup>42</sup> It also produced a further range of metacosmic uncertainty, one fixed upon what lies forever beyond our capacity to know and thus to elicit the patterns and consistencies that to our minds constitute law and order. John D. Barrow, who has written extensively on both the technical and the “more fundamental limits to what we can know about the universe,” marks a limit at the far reaches of the expansion, about thirteen billion light-years away, whose light is our best source of information about the universe's earlier life. Beyond this “cosmic ‘horizon’...we cannot see, even with perfect instruments. There may be an infinite amount of universe beyond the horizon, but we can't see it, we can't receive any signals from it, and we can't tell whether it's just like the part of the universe that we can see.” Indeed the most plausible theory of the structure and evolution of the early universe so far—the inflationary universe—predicts that it is “radically different beyond our horizon,” including such things as the number of dimensions and the properties of the forces of nature.<sup>43</sup>

Carrying such intractable agnosis a step further, the cosmologists Laurence M. Krauss and Robert J. Scherrer raise the alarm that—given our present view of the forever-expanding universe—the things that we now know we may cease to know. And that should happen of necessity, but not because of the inevitable terminal accident or folly that wipes us out or the consumption of the earth and its inhabitants in the red-giant expansion of our sun. It should happen as the universe at large stretches apart and, with the isolation and gravitational consolidation of our local galaxies, everything else disappears beyond the event horizon. In Krauss and Scherrer's account, which is aimed at a general readership,

title and captions approach tabloid eschatology, proclaiming “The End of Cosmology?” “Cosmic Amnesia,” and “The Apocalypse of Knowledge.”<sup>44</sup> The argument is that not only will our universe consist entirely of our own supergalaxy encompassed by the void but that the background radiation that is the lingering signature of the Big Bang will have become undetectably dilute, and the chemical evidence in the proportional distribution of the elements will have been irretrievably lost as well, so that all the information that allows us to deduce our own cosmic genesis and early history will be lost. As perhaps has happened before. The annihilation of knowledge or, worse, of the very possibility of knowledge, in a universal process, would seem to be the final insult to faith in the foundations, the sense of a secure metacosmos. All fades away—as in Pope’s *Dunciad*—in a darkness of the mind, whereby “Lo! thy dread Empire, Chaos! is restor’d.” Moreover, since the supergalaxy to which we will belong will only concentrate more and more under the spell of gravitational attraction, the ultimate fate of our island universe, the known universe, as it then will be, “is to collapse into a black hole.”

In 1876, three years before the birth of Einstein and fifteen years before Wells’s brash challenge, the great physicist and mathematician James Clerk Maxwell wrote that the line of advance in the science of matter and motion could be seen “as a gradual development of the doctrine of relativity of all physical phenomena.” Far from finding this upsetting, Maxwell seems exhilarated at the systemwide coherence and consistency, taking in “the whole body of dynamical doctrine”—even though it means that “We cannot even tell what force may be acting on us; we can only tell the difference between the force acting on one thing and that acting on another.” Moreover, Maxwell can slip into a reflection that if it came from a nonscientist might be thought to express the deepest cosmic pessimism—something on the order of Matthew Arnold’s in “Dover Beach,” longing for a private gleam of constancy and truth while looking out on a universe devoid of meaningful order, moral or physical, a chaos that wounds the soul. Maxwell writes:

There are no landmarks in space; one portion of space is exactly like every other portion, so that we cannot tell where we are. We are as it were, on an unruffled sea, without stars, compass, soundings, wind, or tide, and we cannot tell in what direction we are going. We have no log which we can cast out to make a dead reckoning by; we may compute our rate of motion with respect to neighboring bodies, but we do not know how these bodies may be moving in space.<sup>45</sup>

Maxwell’s bold intellectual reach—and his science—feed into much that is to come, including quantum dynamics, and he here seems to offer a mind prepared not only for relativity theory but for aspects of quantum uncertainty. Those twentieth-century developments furnished the tools for changing the situation he describes, lending a quasi-directional aspect to space itself, for example, as it expands, ruffling the cosmic sea with wind and tide, and supplying fixed reference points or navigational landmarks like the Big Bang in the evolution of space-time. But it is hard not to feel that despite the vision of unfathomable, unanchored drift, Maxwell’s metacosmos remains more secure than that of his successors. There is no acknowledged threat to the belief in scientific law or to the prospect of coherence and completeness in the foundations whereon one can build, no threat to the claims of science to an ideal objectivity and of nature to a reality independent of observation and disjunctive “complementarities,” no natural limits to the reach of mind. It

was still possible to accept the idea of cosmos in the comprehensive sense that informs Humboldt's magisterial and compendious account under that name (1845–1862) of our scientifically knowable world, animate and inanimate, terrestrial and astronomical. We are here still far from a science that asserts that all we are part of floats upon an anomic, irrational ground of accident and paradox, bereft of distinctions between self and other, cause and effect, even being and nonbeing; that the root of the matter, not just before everything was, as in Hesiod and Genesis, but now and forever, is Chaos.

## CHAOS EVERYWHERE

In all chaos there is a cosmos, in all disorder a secret order, in all caprice a fixed law, for everything that works is grounded on its opposite.

—Carl Jung, 1954

In that same treatise on Matter and Motion, James Clerk Maxwell points out that the rational commonplace “like causes produce like effects” does not hold if taken to mean that “small variations in the initial circumstances produce only small variations in the final state of the system.” He points to cases where “a small initial variation may produce a very great change in the final state of the system,” taking as his example a railway disaster. Maxwell might have found much support for this observation in traditional wisdom, as in Mother Goose's cautionary rhyme on the want of a horseshoe nail, as well as in the Voltairean school of history that stipulates, “Great Events from Trifling Causes Grow” (the English subtitle of a once famous play by Eugène Scribe, whose eponymous Glass of Water brings about regime change at the court of Queen Anne and alters the history of Europe).<sup>46</sup> Its modern scientific equivalent is the famous “butterfly effect” of Edward Lorenz, the meteorologist who in 1972 spoke at a meeting of the American Association for the Advancement of Science on “Predictability: Does the Flap of a Butterfly Wing in Brazil Set Off a Tornado in Texas?” and so in retrospect launched the field that came to be known as “deterministic chaos” or, more inclusively, “chaos theory.”

In more ways than one, “chaos” was a misnomer, both for the theory and the phenomena it addressed, just as Jan van Helmont's seventeenth-century coinage labeling his discovery “gas,” from the Greek chaos, was a misnomer or, at best, poetic license. But “chaos” turned out to be a brilliant stroke of evocative branding on the part of its inventor (the mathematician James Yorke) and its early promoters,<sup>47</sup> and it drew into its vortex diverse areas of inquiry and avenues of exploration, albeit with potential commonalities. What is named “chaos” comes down to, by and large, a matter of transitions: not chaos but the road to (and from) chaos, a way of approaching “complexity,” the somewhat more restrained rubric for the field as it evolved. Some have likened its dynamics to phase transitions, as from solid to liquid to gas. Formally, the approach is through algorithmic modeling, which proved to be a simpler matter and one more widely applicable than heretofore suspected. Actually, the transition is through regular stages, from all that we see as orderly—say, a smooth-running stream—to all that we see as chaotic—the turmoil of the rapids, violent, confused, and locally unpredictable. The mechanism supplied by the model,



acting in a range of disparate phenomena, can be described as “period doubling.” Chaos—or, more accurately, mapping the road to chaos—becomes a matter of finding a pattern and a degree of predictability in the changes. It becomes “deterministic chaos.”

In its larger ambitions, this science, also labeled “nonlinear complexity” (“nonlinear” meaning that small variations in initial conditions will have an exponential effect on outcomes), aims at a broader, more inclusive account of the familiar universe of experience than “reductive” analysis provides and as such has been touted as a new paradigm, a revolution as profound as those launched by Newton and Einstein. It also offers a countering impulse to the accumulated pessimism seeded by the entropic vision associated with the second law of thermodynamics and reinforced by the foundational insecurity, conceptual remoteness, and alienated and co-opted subjectivity that shadowed the great achievements of the last century in deconstructing the physical world. For one thing, rather than import indigestible lumps of chaos into an increasingly recondite, disjunctive, and foundationally insecure description of nature (“Chaos is a name for any order that produces confusion in our minds,” said the philosopher George Santayana),<sup>48</sup> it does what science has always done: it brings regions heretofore dismissed as noise and confusion and abandoned to the cloud of unknowing out of chaos and into cosmos. In the language of T. H. Huxley, presumably greeting the Darwinian sunrise, “from the region of disorderly mystery, which is the domain of ignorance, another vast province has been added to science, the realm of orderly mystery.”<sup>49</sup> Or in Santayana’s more cautious but prescient reflections: “Hence we may say paradoxically that a fresh recognition of chaos at the heart of nature may mark an advance in science. It will mark, at least, a closer view of the facts, rendering our preconceptions more consciously human.”<sup>50</sup>

Latent throughout the history of Western science (embedded, for example, in the tension between British science with its empirical bent and the algebraic and theoretical bent of its continental neighbors) is the issue of the relation of scientific description to the world of our experience. As we have seen, modern physical science, notably those branches most fully engaged with fundamentals, projects an abstraction of reality that is no longer imaginable as reality. But even putting that aside, the approach that breaks up a problem and reduces it and the relevant phenomena to their simplest form, eliminating “accidentals,” what cannot be generalized, and manifest complexity, leaves out much of the continuum we inhabit. The turn that gave itself the name of chaos theory claimed as its territory those very regions that have seemed too disordered, too complicated, and too unpredictable to be nailed down by reductive analysis and generalization. Its practitioners have used its toolkit to give an account of what actually happens when a faucet drips, or galaxies collide, or a heartbeat goes wild, or clouds change shape, or stock prices and grouse populations fluctuate, or oak trees and nervous systems branch out in predictable unpredictability—something the precocious young heroine in Tom Stoppard’s *Arcadia*, anticipating Benoit Mandelbrot in the next century, calls a “geometry of nature.” An account of such things as processes can show a path between simplicity and complexity, predictability and unpredictability, through iteration (by feeding outcomes back into the same equations so that “things work upon themselves again and again”)<sup>51</sup> and scaling (how big details are recapitulated in little details, and so on down with no end in sight short of the granularity of matter). The generative

equations for such complexity are in fact relatively simple and of wide application. Thus the tension between generality and particularity is not banished but brought into more intimate and inclusive relations with the phenomenal world. The fruit of these developments has been described as the fostering of an “alternative intuition” in science, a shift in gestalt that “almost amounts to change from never seeing chaos to seeing it everywhere.”<sup>52</sup>

One benefit conferred through these newly opened eyes was a renewed confidence in visuality. As a working scientific tool, visualization had fallen much out of favor in many areas precisely because it chains thinking to experience. Visuality in descriptive language can also be misleading. Think what confusion lies in a “string” theory that postulates entities harboring ten or more “dimensions.” By contrast, chaos put to work the eye’s gift for seeing patterns, notably by converting information into computer-generated images, often set in motion; by mapping the results of iterated differential equations; and by using topological models for probing dynamical systems. In a sense the shift from algebraic reduction to geometric modeling was a return to the science of the Greeks (as we will see in [chapter 3](#)).

When Richard Feynman found himself wishing to convey the feelings he had about the beauty of the world, the mathematical beauty “of how she [nature] works inside,” he put himself in the hands of an artist and learned to draw. One senses a similar aesthetic response in Maxwell when he perceives that “the whole body of dynamical doctrine” falls into a coherent set of principles working (in Feynman’s phrase) “behind the scenes.” Now, in the striking visuality of “the new science,” the aesthetic aspect could declare itself directly. And it was the algorithm itself, feeding solutions back into the equations for as long as you liked, that did the drawing. So it was with the “Lorenz attractor,” where the seemingly random results generated shapes like a moth or a mask out of a sinuous curving line that never overlapped itself—Hogarth’s “Line of Beauty”—or with iterations that, plotted as points, could produce out of randomness startlingly convincing shapes of nature, like a leaf. So it was with the “fractal” patterns in brilliant colors that soon became coffee-table books, run through a computer chip and onto a screen for all to see, mathematics behaving like plants, clouds, shorelines, auroras, galaxies—“nature’s geometry,” number and nature reunited. The images themselves are an embodied dialogue of self-similarity and difference, recurrence and variation, as in music: pattern entangled with infinite variety, regularity with unpredictability, extending not just horizontally but vertically, scale within scale, and endlessly so.<sup>53</sup>

The term “fractal”—coined by Benoit Mandelbrot—has become familiar through such computer imagery. It is often explained by the problems in mapping and measuring a coastline, whose irregularities echo one another at every scale and whose “true” length is either endless or indeterminate. The fractal aspect, that is (etymologically) the broken quality, pertains to a convention of representing dimensionality by whole integers. “Fractal” refers to a value somewhere between. It concurrently implies a conceptual space that lies between chaos entire and order unqualified, managing to partake of both. It in fact speaks to the reality of a degree of each in all natural systems, not excluding the longstanding model of nature’s perfected clockwork, the Copernican/Newtonian solar system.<sup>54</sup> Chaos and cosmos, whose long history in the human imagination has been, almost without exception, as antinomies, now turn out to be inseparables, closely involved and even closely

dependent upon each other for embodied existence. But as usual, the poets got there first: Ben Jonson, speaking of the sea and its waves and breakers as “that orderly disorder which is common in nature”; Novalis, in his vision of a transfigured “rational Chaos—Chaos that has permeated itself, that is both inside and outside itself—Chaos<sup>2</sup> or  $\infty$ .”<sup>55</sup> And in Wallace Stevens’s “Connoisseur of Chaos” (1938), a poem much cited in the scientific literature, extremes meet in a chiasmus of mirroring equations:

A. A violent order is disorder; and  
B. A great disorder is an order. These  
Two things are one. (Pages of illustrations.)

Not without a hint of tongue in cheek, the poem offers a dialectic that transcends contradiction, but one finally grounded in the encounter of mind and nature for “the pensive man to see”:

The squirming facts exceed the squamous mind,  
If one may say so. And yet relation appears  
A small relation expanding like the shade  
Of a cloud on sand, a shape on the side of a hill.<sup>56</sup>

That is to say, from out of the vast confusion is born the germ and contagion of order.

Channeling the muses of Novalis and Stevens, one latter-day philosopher of science roundly declares, “Chaos is not disorder. It is a higher form of order.”<sup>57</sup> In that declaration, resting on current science, a prediction by the historian Gerald Holton on a coming turn in the road for science is patently fulfilled. Having pointed out how the characteristic leanings of modern science toward motifs of “disintegration, violence and derangement” had displaced those of hierarchy, continuity, and order, Holton anticipates the return of “the antitheme,” but in a new, more sophisticated guise.<sup>58</sup> What is new and sophisticated in this return of the elements of order is their newly forged intimate partnership with “chaos.”

## LOOKING ASKANCE

As a cultural phenomenon, the stunning success of chaos theory in migrating from the laboratory to the marketplace elicited cautionary reservations and in due course some dismissive reactions, including a few that would have been appropriate to a New Age product whose life-enhancing properties had been oversold. From T-shirts and posters to museum and gallery shows of chaos-inspired art, from shop signs and sci-fi to theater and film, chaos took on celebrity and easy cultural familiarity.<sup>59</sup> But an on-the-whole-friendly report in *Science*, for example, asked, “Chaos Theory: How Big an Advance?” It raised questions about its novelty and revolutionary claims and took note of the exasperation of one of its originators, James Yorke, at the scientific community’s neutering response: “Now that they’ve found chaos, they want to look for order in chaos.”<sup>60</sup> A lucid, “intuitive” account of the science and its potential applications in the *New Left Review* offered the salutary warning that “the connection between the mathematical formalism of chaos theory and

events in the real world is considerably more problematic than is often implied in general expositions.”<sup>61</sup> A skeptical review of two books both titled *Complexity* (and nearly identically subtitled: *Life at the Edge of [Order and] Chaos*) notes that “Previous attempts in this century to find a universal science to explain the world’s structures have collapsed in a mass of unfulfilled promises,” citing René Thom’s catastrophe theory and Ludwig von Bertalanffy’s general systems theory. (Other critics mention cybernetics and information theory.) As for complexity—touted by its enthusiasts as a more comprehensive successor to chaos—the reviewer writes that “One imagines a movie marquee: ‘If you liked chaos, you’ll love complexity.’”<sup>62</sup> A more substantial and even less polite report, labeled “Trends in Complexity Studies,” notes that “Complexologists have struggled to distinguish their field from a closely related pop-science movement, chaos. When all the fuss was over, chaos turned out to refer to a restricted set of phenomena that evolve in predictably unpredictable ways.”<sup>63</sup> The article quotes the mathematician David Ruelle, “a pioneer of the field,” to the effect that, in spite of successive announcements of novel breakthroughs, chaos “has had a declining output of interesting discoveries” (109). But as James Yorke ruefully observed about chaos studies, a feature in complexity that kindles considerable interest focuses on how order emerges out of chaos, in the seeming impulse toward self-organization, what one scientist calls “autocatalysis.” In that emphasis, complexity in effect inverts the initial thrust of chaos: not the road to chaos now, as the path of interest and discovery, but (as in so much early cosmology) the road from chaos.

In his critical report on “Trends in Complexity Studies,” John Horgan calls attention to “a brilliant paper” by Naomi Oreskes (a philosopher) and others on the relation between mathematical models and natural systems. The relation, argues the paper, is one of convenient analogue rather than anything capable of validation. The authors pursue their own analogue in characterizing such a model “as a work of fiction”:

A model, like a novel, may resonate with nature, but it is not a “real” thing. Like a novel, a model may be convincing—it may “ring true” if it is consistent with our experience of the natural world. But just as we may wonder how much the characters in a novel are drawn from real life and how much is artifice, we might ask the same of a model: How much is based on observation and measurement of accessible phenomena, how much is based on informed judgment, and how much is convenience?<sup>64</sup>

It is instructive to compare this, with its implied critique, to Virginia Woolf reflecting on what it would be like to write a modern novel that erased the gap between the model and the thing it intends to represent: life itself in its chaotic, numinous plenitude.

Is it not possible that the accent falls a little differently, that the moment of importance came before or after, that, if one were free and could set down what one chose, there would be no plot, little probability, and a vague general confusion in which the clear-cut features of the tragic, the comic, the passionate, and the lyrical were dissolved beyond the possibility of separate recognition? The mind, exposed to the ordinary course of life, receives upon its surface a myriad impressions—trivial, fantastic, evanescent, or engraved with the sharpness of steel. From all sides they come, an incessant shower of innumerable atoms, composing in their sum what we might venture to call life itself; and to figure further as the semi-transparent envelope, or luminous halo, surrounding us from the beginning of consciousness to the end.<sup>65</sup>

Oreskes and her collaborators use as their model that dominant form of the novel associated with realism, where the fiction negotiates between the divergent claims of “the



natural world” and the formal requirements and limitations of the medium—conventions of narrative, shorthand characterization, judicious emphasis, effective contrast, genre expectations. Woolf, in her critique of the mainstream novel, conscious of its typifying adjustments and compromises, rather wistfully imagines something not in effect a model of life but life itself or, at least, life as experienced by a mind not bent on reducing it to rule and reason, sequence and cause, category and distinction, the presumptive essentials of meaningful order. She imagines something perilously close to William James’s chilling account of what it would be to live fully open and fully attuned to the unfiltered impressions and sensations of the moment or the unqualified actuality of the now—redeemed, however, in Woolf’s sensibility, from intolerable chaos by a consciousness of the wonder of being. That is “the semi-transparent envelope, or luminous halo” that surrounds and pervades the risk-taking novel in which Woolf the writer found her freedom, *To the Lighthouse* (1927). And it is not far from the wonder that captured the imagination of so many in the revelation of a realm of orderly disorder that went under the name of Chaos.

## CHAOSMOS

The discovery that an intractable randomness can be generated out of simple deterministic systems, out of the complex interaction of bodies in motion, and from inevitable margins of error was not without resonance in the quantum regime, which was attuned to limitations in mensuration and unpredictabilities in behavior. In a cautious bridging analogy linking the micro and macro worlds, the authors of one of the best concise accounts of chaos and its implications note that, prone to exponential amplification, “any effect, no matter how small, quickly reaches macroscopic proportions.” Accordingly, “quantum mechanics implies that initial measurements are always uncertain, and chaos ensures that uncertainties will quickly overwhelm the ability to make predictions.”<sup>66</sup> But micro or macro, both forms of uncertainty undermine the scaffolding that supports the antinomy of chaos and order. Both cut the ground out from under the claims of Laplacean determinism. And now on the macroscopic level, order and chaos achieve a fuller form of “complementarity”—of true codependence—than their previous life as antonyms would predict. One feature of such interinvolvement reflects back upon the entropic cosmic scenario. As early as 1953, Enrico Fermi and his collaborators, seeking a fuller understanding of the tendency to entropic decay in all natural systems, turned up instead, in certain chemical bonds, what seemed to be, in the midst of decay, “a penchant for order.”<sup>67</sup> In 1977 the Belgian scientist Ilya Prigogine, who received a Nobel Prize in chemistry for work in the 1960s on “dissipative structures,” postulated systems in disequilibrium that were able to increase in complexity and organization by importing energy and “exporting” entropy. Two years later he and his collaborator, Isabelle Stengers, published a book for a wider audience called *La nouvelle alliance*, or, in English, *Order out of Chaos*, making the case for (among other things) processes in nature that batten upon entropy and show a penchant for self-organization—with evolutionary science providing the relevant model.<sup>68</sup> Studies of how pattern arises in nature, as in the flow of sand, deal both in emergent pattern (e.g., ripples) and achieved equilibriums, or “self-

organizing criticality.” Whether there are undiscovered “laws” at work in the capacity for self-organization, or whether a straightforward dependence on randomness is all that is necessary for what appears to be the spontaneous emergence of order from chaos, are matters unresolved, but in any case the negentropic countercurrent of qualities we associate with order, emerging in dynamic states whose characteristics we associate with chaos, asks for an accounting and bespeaks their interinvolvement not just in our minds but throughout nature.<sup>69</sup>

Meanwhile, the picture of an entire universe, the universe, either as a closed or an infinitely expanding system, with or without large-scale structure and galactic clustering, but in any case spreading itself thin and running down, has found competition in a burst of alternative scenarios, some of the most intriguing ones leaning on the theory and evidence of “inflation” from a virtual nothing. Alan Guth, the primary architect of inflation, writes that the refinement of his initial conception, with many hands addressing its problematic aspects and its broader implications, leads to a concept of “eternal inflation,” with the universe engendering and hiving off pocket or bubble universes (like our own at the start) at a prodigious, accelerating rate: universes within universes, a fractal pattern of bubble universes. “Infinite pocket universes,” he writes, “is an unavoidable feature of almost all versions of inflation.”<sup>70</sup> He recalls two recent but bypassed versions of an eternal universe: steady state (associated especially with Fred Hoyle), with new matter constantly created as the universe forever expands, so maintaining more or less the same density; and oscillating, cyclically expanding and collapsing in a see-saw of propulsive and gravitational energies (249). “From a view that shows all the pocket universes, the evolution will strongly resemble the old steady state model of the universe. As the pocket universes live out their lives and recollapse and dwindle away, new universes are generated to take their place.... The universe as a whole will regenerate eternally...while life in our pocket universe will presumably die out” (243). Andrei Linde, who with much imaginative verve has pursued this vision of bubble universes fluctuating into existence and branching and expanding into the void, pictures the fractal results in vivid schematic imagery.<sup>71</sup>

In our own bubble universe, if that is what it is, the generation of natural forms from a simple set of rules with built-in randomness has been, for the metaphysically inclined, the most intriguing aspect of this invention of “chaos.” All depends, however, on what one is prepared to see. If one sees a universe grounded in fundamental chaos—randomness, unpredictability, indeterminacy—then the science charts the spontaneous emergence of self-organization. If one sees a universe grounded in fundamental order—causality, predictability, uniformity—then the science shows deterministic systems generating randomness. But perhaps one does not have to choose; randomness and recurrence give rise to rule, and rule, reflexively, generates randomness, ineluctably bound in “the chaosmos of Alle.”<sup>72</sup>

Cosmos, in human myth and experience, is what can be carved out of chaos and grasped by modeling, by assorting, by explaining origins, by learning what to expect. Characteristically, “the new science of chaos,” renamed “complexity,” addressed transitions and boundary states, in a borderland between regular flow and turbulence, between periodicity and unpredictability. It opened a whole new world, heretofore “invisible,” of

symmetries and homologies in nature. It offered a set of ideas and equations, and even a mathematical constant, that brought into one conceptual space an extraordinary diversity of phenomena and disciplines. In other words, the science called chaos was creditable science because it made inroads on territories heretofore abandoned to chaos and gave us a handle on the spoils. Even so, it along with the intrinsic uncertainties of the quantum regime and its macrocosmic analogues are only the latest chapter in a long story of attempts—by artists, poets, philosophers, and scientists—to grapple with those uncharted territories in the raw and compel them into imaginable, representable form. It is a story with twists and turns, shrouded beginnings and incompatible endings, but finally a story that asks to be told.



# SHAPING CHAOS

Where thought is, there is indirection.

—Geoffrey Hartman

**W**hat chaos really is, in and of itself, and what sort of figure it truly cuts in the universe at large—an open question—is not something I know how to address. The notion of chaos is a different matter. The notion of chaos in its most general and traditional framing is a limiting case: the extreme of disorder, where all attributes assignable to order vanish. It is disorder made absolute. It follows from a desire to give shape or a name to our perceptions of discontinuity and dissonance, of confusion and incoherence, perhaps to quarantine them from what belongs to symmetry, shapeliness, and consequence. To attempt to represent chaos at the full, as surprisingly many have done, is a desperate business requiring a good deal of poetic imagination. To attempt to set out the shape of that lawless condition is on the face of it a paradoxical undertaking, like that of Descartes rationalizing the passions or Freud making us conscious of the unconscious, since it seems to entail the undoing of the essential character of the given.

Not what chaos really is, but the imagination of chaos, and some of the stratagems for its representation in the mindscape of our history, are what I have in mind to explore. Art and literature in this respect offer as rich a field of inquiry as philosophy and science. Indeed, the formal separation of these categories at some point in the Western tradition (the tradition to which I chiefly but not entirely confine myself) clearly will not work for such as Hesiod, Plato, Ovid, Lucretius. Moreover, even in the nineteenth and twentieth centuries it scarcely makes sense to consider the representations of chaos in the work of Goethe, Turner, Carlyle, Zola, Henry Adams, Beckett, Pynchon, and Cage, and in the work of Kelvin, Clausius, Gibbs, Boltzmann, Heisenberg, Gödel, and Feigenbaum, as if they could only be understood as science or imagination but not both. Indeed, if poetry and cosmogony were once happily married in ancient thought, they are at the very least freely cohabiting in modern physics and cosmology.

My special but far from exclusive interest is the representation of chaos in literature and art, with the thought that in the enterprise of imagining chaos it is the artist who has had to take most seriously the obligation of making chaos concrete. The mind moves readily to the abstract notion of absolute disorder, but it meets a stiff resistance, probably in its own constitution, when it comes to the concrete imagining of such a condition. I doubt that anyone could better convey the difficulty of really imagining chaos than St. Augustine in his *Confessions*:

I conceived of it as having innumerable forms and diverse, and therefore indeed did I not at all conceive of it in my mind... my mind tossed up and down certain ugly and hideous forms, all out of order, but yet forms they were notwithstanding; and this I called without form...true reason did persuade me, that I must utterly uncase it of all remnants of forms whatsoever, if so be I meant to conceive a matter absolute without form: and I could not. For sooner could I imagine that

not to be at all, which should be deprived of all form, than once conceive there was likely to be anything betwixt form and nothing; a matter neither formed nor nothing; formless, almost nothing.<sup>1</sup>

Augustine, as serious about eliminating form in his pursuit of chaos as any Dadaist looking to extirpate meaning, here names some of the common strategies, or to him evasions, for its representation: endless multiplication and diversification, creating a jumble of forms, creating monsters, and pursuing the *via negativa* until it runs aground in a shadowy approximation of nothing.

Conceiving chaos—Augustine’s concern—has a no less troublesome partner in the perceiving of it. For most of us the perception of chaos, of unmitigated disorder, appears to go much against the grain. Though in politics and morals and in aesthetics we are quick to cry chaos, it is only the word that comes easily. It is hard not to find some semblance of rhythm, some vestige of form and purpose, some seemingly selective regularity, in what experience offers. We are pattern-seeking, pattern-making animals who live and adapt by making sense of things and who break old patterns only to make new ones. We hear relations in aleatory music, we see rhythms in the action of paint, we feel conspiracy in the workings of chance.

In *Moby-Dick*, Melville’s grand epic of the consuming need to find a meaning—however terrible—in the universe of experience, the author posts an exemplum of that human imperative near the head of the text. In [chapter 2](#), Ishmael describes entering the Spouter Inn, where he encounters “a very large oil-painting, so thoroughly be-smoked, and every way defaced, that in the unequal cross-lights by which you viewed it, it was only by diligent study and a series of systematic visits to it, and careful inquiry of the neighbors, that you could any way arrive at an understanding of its purpose.” A first near-thought in the presence of “such unaccountable masses of shades and shadows” is that “some ambitious young artist, in the time of the New England hags, had endeavored to delineate chaos bewitched. But by dint of much and earnest contemplation, and oft repeated ponderings, and especially by throwing open the little window towards the back of the entry, you at last came to the conclusion that such an idea, however wild, might not be altogether unwarranted.” Ishmael’s last sentence does not culminate in the expected conclusion, though surely a deep reluctance to see unmeaning chaos lies in its hedged and qualified final clause, after the valiant many-sided effort inscribed in its opening.

Even with chaos so begrudgingly allowed as the possible subject of the image, the viewer cannot permit himself to rest. Puzzled and confounded, Ishmael continues:

A boggy, soggy, squitchy picture truly, enough to drive a nervous man distracted. Yet there was a sort of indefinite, half-attained, unimaginable sublimity about it that fairly froze you to it, till you involuntarily took an oath with yourself to find out what that marvellous painting meant. Ever and anon a bright, but, alas, deceptive idea would dart you through.—It’s the Black Sea in a midnight gale.—It’s the unnatural combat of the four primal elements.—It’s a blasted heath.—It’s a Hyperborean winter scene.—It’s the breaking-up of the ice-bound stream of Time. But at last all these fancies yielded to that one portentous something in the picture’s midst. That once found out, and all the rest were plain. But stop; does it not bear a faint resemblance to a gigantic fish? even the great Leviathan himself?<sup>2</sup>

The catalogue is exhausting if not exhaustive, and it represents, albeit as comedy, the mind’s restless inventiveness in the face of the persistently, suggestively, inchoate. From black on black to white on white, it reels from one imagined chaos—as found in Ovid,

Shakespeare, Mary Shelley, Genesis, Revelation—to another. And eventually, something emerges, as it does from Turner’s whaling paintings, whose reception Ishmael unwittingly suggests. Ishmael’s final theory is that the picture represents a ship in a great hurricane, half foundered and weltering so that only the remains of its three masts are visible, “and an exasperated whale, purposing to spring clean over the craft, is in the enormous act of impaling itself upon the three mastheads.” Under extreme provocation, the baffled mind resorts to violence: an apocalyptic religious vision of universal crucifixion, but the excruciation has been in fact that of the would-be interpreter, seeking to stabilize a pattern, a meaning, in the infinitely suggestive meaninglessness.

If perfect, unmitigated disorder absent all meaning is intolerable and perhaps inconceivable, as Ishmael’s struggle suggests, what about perfect order? Does one require a devious strategy to give it concrete representation as well? Does it bear contemplation, and for how long? Is there a comparable resistance in perception or conception? At first blush it would seem not—given the apparently universal appetite for symmetries and regularities, the invention of equations and utopias, of the Golden Age and the diapason. But then one has to think of the difficulty in sustaining the perception of a perfect order, of sustaining attention once the principle has been grasped and the problematic intricacies, the epicycles, have all been exhausted. In those Last Judgment scenes where the saved souls in their ordered rows all look alike, having attained the perfection of human form, one turns quickly to the devils and the damned. Utopias, fancied or decreed, reliably generate dystopia and dissidence. In classic experiments in sensory deprivation, where silence, darkness, and climate control come as close to providing perfect peace as organic life allows, the mind invents its own interruptions in the form of hallucinations.<sup>3</sup> And as for the need for indirection in giving dazzling perfection concrete and apprehensible representation, God, in consideration of man’s limited capacity, reveals himself to Moses, in passing, by showing his back parts. There is surely a message in that.

Thus, with perfect order as with unrelieved chaos, there is a resistance that makes itself felt not only in the realm of experience but in the workshop of the imagination. Part of the sport in looking closely at some of the most effective representations of unlimited chaos in what follows is in unearthing the elements of order that, like it or not, insinuate themselves within the strategic indirections. Often these inhere in the medium itself, the language of representation, but often they seem gratuitous, indicative of an impulse to resist disorder or even to encode a secret order. An example of the first is Haydn’s marvelous “Representation of Chaos,” the movement that opens his Creation, speaking in the musical language of the late eighteenth century (discussed in [chapter 6](#), “Energy: Matter in Motion (Inertia, Friction, Noise)”). A vivid example of the second is an illustration offered as an image of the primal chaos by the Flemish artist Abraham Diepenbeek, designed originally in about 1655, for an elaborate book of engravings inspired by Ovid’s *Metamorphoses* ([fig. 1.1](#)). In his poem, Ovid describes the primal chaos as a formless, unstable mass, the inchoate elements heaped together and at war with each other, cold with hot, moist with dry, a confusion of land, sea, and air. In his visual representation, Diepenbeek adds to the traditional four elements—Earth, Air, Water, and Fire—the signs of the zodiac; some other animal figures, alchemical or astronomical or both; sun, moon, stars, rock shapes and cloud

shapes scarcely distinguishable; and beyond all (in the words of the accompanying text) “an immense Abyss of Darkness.” Not only the elements but the constellations of the zodiac are at war with each other, while additionally Canis challenges Serpens and Ursa the sun. Water and fire stream in all possible directions, rocks pile up with no heed to gravity, “the Stars are scattered up and down, some fixt to Rocks, others wrapt in Fire, and others plunged in Water; and to complete that artful Confusion which runs thro the whole Piece, the very Name of the Painter is jumbled into the Mass, and writ in the Heavens.”<sup>4</sup> Yet the image (originally without borders) takes the form of a wide-bottomed ellipsoid, appropriately egg shaped, though essentially two-dimensional, within the conventional rectangular plate. It has a rough bilateral symmetry. One of the four elements, Air, is represented by the winds, which are also four. These are distributed in an inverted Y, mirroring and embracing the thrusting Y of rock and cloud slanting toward the viewer in the lower left foreground. And most insidiously, the zodiac, though all out of normal order, is at war not randomly but logically, each sign with its calendar opposite, six months apart: Aquarius with Leo, Sagittarius with Gemini, Capricorn with Cancer, etc. The fighting zodiac pairs fall into two arcs on either side of the diagonal marked by the sun and moon, one arc of the odd months and one of the evens, in the order (starting with January) 1/7, 3/9, 5/11 and 2/8, 4/10, 6/12. It would appear by this “artful Confusion” that if primal chaos was for the universe primal innocence, number is the true serpent in the garden and symmetry and pattern the tempting fruit, the insidious agents of the fall.

The trouble with “absolute” chaos and “perfect” order may lie not in the nouns but in their uncompromising modifiers. In any event, neither extreme seems to suit our “genius,” the native bent of our minds and feelings. It is nevertheless undeniable that perfect order has had a better press. It may be that our situation as a species has made the obligation of finding and making regularities more pressing, disruptions of the safely familiar more alarming. Accordingly, the foreground concerns of most history of ideas, as of much cultural anthropology, have been ideas of order, with chaos admitted and represented chiefly as the radical threat in the background to be contained, or as the defect of order. Similarly, the traditional account of art has identified it with a schematics of order and has seen art as eliciting order from the chaos, real or apparent, to achieve a *claritas* that for the scholastically inclined is the ultimate ground of beauty. It is true that serious attention to the role of disorder or irregularity in art has not been lacking, at least since Longinus. It is true that the nineteenth-century artist might be disposed to insist, with Novalis, that “in every work of art, Chaos has to shine through the veil of order” and that the twentieth-century artist has often done his brazen best to strip the bride bare.<sup>5</sup> But traditionally and conventionally, disorder in art belongs to the recalcitrance of the materials, language included, or to the ineptitude or ambivalence of the maker, so that a book like Morse Peckham’s *Man’s Rage for Chaos*, reversing the classical perspective and arguing that the disruption of forms, conventions, and regularities is the biological function of art, its very reason for being, remains a challenge to an ingrained orthodoxy.



FIGURE 1.1. Abraham van Diepenbeek, *The Chaos*, after Ovid (1655), engraved by Bernard Picart, illustrating *The Temple of the Muses* (Amsterdam, 1733).

Source: Collection, Library of Congress.

In investigating the representation of chaos in and out of art, I do not intend to pursue Peckham’s argument, though I do intend to reverse the usual perspective and treat order as background, the latent presence whose regular outbreak in those same representations can be too insistent to ignore. I hasten to add that there is nothing in the subject of the imagination of chaos that requires chaotic expression. But the subject is surely complex, and it dictates no inevitable shape. Consequently, I find myself divided between the appeal of a conceptual approach and one more strictly historical and chronological. What emerges—in the interests of giving prominence to what is most pertinent—is a compromise that leans to the conceptual or thematic but attempts to have it both ways, a compromise facilitated by the fact that to some extent the conceptual and the chronological coincide. That is, there were eras when certain biases in the conception of chaos were especially prevalent or especially revealing, so that one may order the succession of categories to take account of a broadly historical succession as well. Because there is a historical side to the imagination of chaos, it is even possible to claim that its shifts and changes can serve as an index to some historically significant turns in the course of Western civilization, from Hesiod and Genesis to Blake and Heisenberg. Nevertheless, chronological focus on a given



era will sometimes appear to be distinctly overwhelmed in the course of exploring further developments. That will be evident in the first section to follow, “Nothing and Something,” where the exemplary texts and images range from about 1400 B.C. to the mid-twentieth century.

Additionally, there are four broad avenues that run through the long encounter of the world of thought and that of experience here making their appearance: cosmogony, psychology, aesthetics, politics. Cosmogony provides the earliest instances of the representation of chaos, chaos with reference to the physical world, and its succession includes the assertions and extrapolations of nineteenth-century thermodynamics and twentieth-century quantum mechanics. Psychology embraces not only projections of the aberrant mind’s disorder but epistemological and moral concerns, issues of the relation between internal and external realities. Politics projects apocalyptic dissolutions and disabling incoherencies within states and societies and between them. Aesthetics incorporates preoccupations with dissonance, kinesis, and accident. The aesthetics of chaos is an oxymoron that nevertheless has found expressive elaboration in the theory and practice of generations of working artists.

Cosmogony, psychology, politics (and society), aesthetics—these are also the contexts within which the wholly abstract idea of disorder made absolute can seek concrete expression. You cannot imagine disorder in a vacuum, as Augustine shows, though disorder as vacuum, as absence, material and otherwise, may be one paradoxical form of the attempt to give it substance. In general, the strategies for representing chaos begin with its contextualization, so that the endeavor to imagine and represent chaos as such is only half the story. The other half originates in and with the context and reflects the human disposition to characterize as “chaos” disordered or unfamiliar states in every corner of experience. The term is as easily attached, and as easily abused, as “tragedy,” but beyond its convenience as shorthand hyperbole, there is a serious cognitive and a serious conceptual side to its invocation. The cognitive side enters where the complexity of a set of phenomena passes beyond the mind’s ability to contain and control the experience (I discuss this later, in [chapter 3](#)). The conceptual side enters where an artist or thinker wishes to release experience from the mundane or, more radically, to transform how it is perceived and understood. In such a case he or she can draw on the power of an evoked chaos to disconcert and revolutionize how we see and feel about reality.

Formal strategies in the representation of chaos are constrained first of all by the nature of representation itself. This has to be finite and contained, whereas chaos typically carries with it the sense (or the threat) of something unbounded and uncontained. Contextualization is also limitation, and that requirement makes incumbent further indirections in the strategies of representation. When chaos appears as the background to cosmos, as in many creation myths, much can be forgiven—left in the dark or only intimated. But when chaos is to be the figure rather than the ground, then it becomes unavoidably clear that chaos as such is unsuitable for framing. Most often the required indirection operates to destabilize figure and ground, so that chaos appears as something that breaks out, or threatens to break out, as in what Goya called the “sleep of reason”: an insurgency rather than a condition. Even the mathematics of chaos in its late nineteenth- and early twentieth-century form follows such a

course of would-be containment and embeds causal unpredictability in statistical probability, and its twentieth-century avatar, the “new science” of chaos, as we have seen, flaunts the name of chaos while devoting itself to the quest for regularities where none were perceived before—generative rules, constants, encrypted figures and recurrences—so enlarging the kingdom of Order.

The categories that seem to me most useful in a conceptual approach to the imagination of chaos are the following: NOTHING, NUMBER, CARNIVAL, WAR, ENERGY, ENTROPY. These are the rubrics that preside over each of the pivotal sections that follow. Though time sensitive, no section is strictly time bound. It is in the later sections, however—ENERGY, ENTROPY (and the untethered epilogue, invoking UNCERTAINTY and COMPLEXITY)—that science as a differentiated realm of organized thought takes the lead in shaping the imagination of chaos.

In art and thought, the formal strategies for the representation of chaos are closely linked to these conceptual categories. Some representational strategies are close to self-evident: negation for Nothing, for example; inversion for Carnival. But some are less obviously grounded, like anarithmia or monstrosity, and these I hope to anchor in showing how they were used. Some formal strategies are in effect free floating. I have in mind personification, arguably invention’s first resort in seeking to project an embodied chaos, from the Babylonian Tiamat to Rubens’s Mars, Milton’s Chaos, and Shelley’s Anarchy, all of whom make an appearance below. Strategies of representation (like personification) could perhaps be approached more technically, through the descriptive language of rhetoric and poetics, but I doubt more usefully. One broad division between representational strategies is that between imitation and analogue: between Dada, let us say, and the plays of Samuel Beckett. The one is an attempt to enact chaos directly, by eliminating what passes for order, and the other an attempt to map chaos through a rigorously ordered algorithm. Both approaches recur through the series of conceptual categories that serve as the ordering armature of this book.

The reader should be prepared for a rude shifting of gears as the book moves on to later periods, when science as a differentiated pursuit takes center stage and provides the conceptual thrust for the imagination of chaos. Energy and entropy—high scientific abstractions—are not readily associated with particular strategies of representation, like a rhetoric of negation or carnival inversion. Moreover, they call for greater temporal specificity, given their nineteenth-century formation, and they are embedded in an intellectual enterprise and a disciplinary practice—sometimes at war with itself—that here requires a fair amount of scientific and historical exposition. Though developing alongside and then invoked, deployed, and translated into other forms of cultural expression, the scientific ideas themselves lay down the line I will attempt to follow in its unfolding and imaginative impact. For within the enlarging framework of nineteenth-century thermodynamics and then again in the twentieth century’s astonishing forays into the fundamental nature of material being, the imagination of chaos, in its antithetical relation to cosmos, is being radically reconceived.

What is at stake for human beings in the imagination of chaos? Why its persistence in the face of so much ambivalence and recalcitrant mental equipment? There are clues in the opposing terms that regularly frame its representations: chance and necessity,



formlessness and form, heterogeneity and homogeneity, randomness and predictability, the many and the one. What is at stake is the universe. But the local energies that drive the imagination of chaos come from more intimate levels, inhabited by feelings about action and constraint, desire and limitation, liberty and security, violence within and violence without, by the appetite for life and the fear of its inevitable undoing. These energies show themselves directly and indirectly in the representations of chaos, with memorable effect: in, for example, the charged arguments over the existence of the void and in what has been called “the excremental vision.”<sup>6</sup> In *The Dunciad*, Pope’s great vision of the undoing of Creation by Dulness (addressed in [chapter 4](#)), the assimilation of chaos to the cloacal reflects a revulsion from threats of transgressive and promiscuous mingling, the leveling adulteration of difference, and the monstrous yoking of incompatibles, tendencies that in the end succeed in restoring the Empire of Chaos and universal Darkness.<sup>7</sup> But the alliance between chaos and the cloacal is also tied here to what is most impelling in the excremental vision and in the satiric animus of the poem: a horror of decay and dissolution rooted in the prospect of death. Satire, as almost all its expounders have observed, is a form of exorcism, aggressively purging what one fears and loathes. And as Michael Seidel (following Juvenal) further argues, “In a sense, to be named in satire is to be already dead.”<sup>8</sup> Such satire as Pope’s declares as “dead” and moves to inter not only its corrupt targets but death and corruption itself.

Yet if the excremental vision in these and other instances offers a source of psychic energy for the imagination of chaos, it is by no means a key to the whole. If it links chaos to death and dissolution in Pope’s *Dunciad* and Dickens’s *Our Mutual Friend*, it works quite differently in Rabelais’ *Gargantua* and Jarry’s *Ubu Roi*.<sup>9</sup> There the excremental is the rude antidote to a costive propriety and sterile pedantry and “chaos” the expression not of the end of function and coherence and the return to nothing but of vitality. It is the defiant, celebratory assertion of life over form.

# NOTHING AND SOMETHING

When you are philosophizing you have to descend into the ancient chaos, and make yourself at home.

—Ludwig Wittgenstein

**T**he most direct of the indirect routes to the unimaginable is negation. It is where a troubled St. Augustine is driven in his failed attempts to imagine chaos, when his mind rejects even a something “betwixt form and nothing; a matter neither formed nor nothing; formless, almost nothing.” In the sixteenth century, the inveterate teacher Sir Thomas Elyot, defending “the discrepance of degrees, whereof proceedeth ordre,” finds the subtractive route to chaos less problematic: “Moreover, take away Ordre from all thyngs what shoulde then remaine? Certes nothing, finally, except some man would imagine eftsoones Chaos, which of some is expounded, a confuse mixture.”<sup>1</sup> As Augustine’s attempted imaginings intimate and Elyot’s response to his own question asserts, nothing and chaos might be more closely linked than it at first appears. If by taking away order from all things one is left with “nothing,” whereupon chaos leaps into the breach, there would seem to be an underlying affinity between negation reified and disorder made absolute.

Chaos and nothing are linked conceptually and imaginatively along the pathways of language, by sharing an antonym. In much cosmological discourse, chaos is the name of that which is opposed to cosmos, an ordered universe. But the notion of a universe in being attracts another fundamental antithesis: not-being, a nothing opposed to something, yielding as opposites the cosmos and the void. By equivalency, chaos becomes the void, becomes not simply an alternative something but the nothing that is negation abstracted and nominalized. When by “taking away” one reaches “nothing finally,” which—as Elyot says—then may be imagined as chaos, negation has passed from an operation to a concrete universal.

The commonest meaning attached to the word “chaos” in our current speech is energetic and abundant confusion, a sense more suggestive of overwhelming presence than of blank absence. Yet in its etymology, its early cosmic significance, and its long association with origins and endings, “chaos” is fraught with this notion of nothing, of a something that is nothing. From Hesiod through the Greek physical philosophers and their atomist successors, the Christian rationalizers of the biblical and classical traditions, the eighteenth-century celestial mechanists, the nineteenth-century thermodynamicists, and on to the recent pioneers of nonlinear dynamics and inflationary cosmology, the scientific accounts of chaos have alternated between extreme states of energetic irregularity and of vacuous or brooding inactivity. The series begins, however, with absence, a hiatus that quickly becomes, in imagination, negative presence. In what follows, I shall largely proceed along avenues deriving from classical and biblical representations of a nothing that stands in for chaos. But despite the important common thread to be found additionally in a rhetoric of

negation, there is no progressive narrative to be elicited in the involvements of chaos with nothing, except perhaps a movement toward inwardness. The challenge of speaking of nothing shows itself here as my attempt to do justice to often bold but abstruse or convoluted representations necessarily mired in paradox. For those thinkers and fabulists so engaged with nothing, however, a great deal more was at stake, in what turns out to be essentially a quest for origins, since origins seem to offer our best clue to that most elusive and desired good, the meaning of something—or here, of Everything.

Representation by way of subtraction is one intellectual strategy; representation through paradox is another, as in the case of the nothing that is something. Paradox is a form of words that suggests conceivable truths beyond the logic governed by language and beyond mere oxymoron. But it can also sometimes speak in images. Such an image is Giacometti's twentieth-century sculpture, *Hands Holding the Void* (fig. 2.1). Title and sculpture import holding the unholdable, the absent, holding absence itself. The staring eyes with their fractured irises complement the delicate hands, poised as if on an object, empty, but marking and shaping a space. Space, the container, is—seemingly—contained; absence is made present; nothing is given a form.



FIGURE 2.1. Alberto Giacometti, *Hands Holding the Void* (1934).

Paradox, as we shall see, is inherent in the very name of “chaos.” But the simpler route to the representation of chaos is a rhetoric of negation, which is often allied with subtraction though not one and the same. Seen unkindly, it furnishes the easiest way to evade imagining the unimaginable. But it can be extremely sophisticated, as in the ancient creation hymn in the Rig Veda (ca. 1400 B.C.), verging on a tissue of paradox, or exceedingly formulaic, as in numerous later poets who took their cue from Ovid. The Sanskrit poem postulates its antecedent chaos—the word not yet invented—as lying in an excluded middle, and it interrogates rather than simply asserts its defining absences:

There was no nonexistent; and there [was] no existent at that time. There was neither the mid-space nor the heaven beyond. What stirred? And in whose control? Was there water? The abyss was deep. Neither death nor deathlessness was there then. There was no sign of night or day. That One breathed without wind through its independent power. There was nothing other than it. Darkness there was, hidden by darkness, in the beginning. A signless ocean was everything here. The potential that was hidden by emptiness—that One was born by the power of heat....<sup>2</sup>

The poet or poets who put the Rig Veda into words were only the first we have of the many thinkers and poets who sought to address “the potential that was hidden by emptiness.”

## SOMETHING OUT OF NOTHING?

The root of the word “chaos” is the Greek verb stem *Xa*, meaning to yawn or to gape. It enters Western poetic and philosophic discourse in Hesiod’s *Theogony* (ca. seventh century BC), in his account of the very beginnings:

Truly, first of all did Chaos come into being, and then broad-bosomed Gaia [Earth], a firm seat of all things forever, and misty Tartaros in a recess of broad-wayed earth, and Eros, who is fairest among immortal gods.... Out of Chaos, Erebus and black Night came into being; and from Night again, came Aither and Day, whom she conceived after mingling in love with Erebus.<sup>3</sup>

The genealogy in this account of primeval events is complicated. It could hardly be otherwise with only partly anthropomorphized entities whose ontology is left impressively and perhaps deliberately clouded. But it is clear that the direct progeny of Chaos—Erebus (Darkness) and Night—are of a negative cast, and even the incestuous generation that follows from these two, Aither and Day, are considerably less substantial than the earthborn progeny of Gaia (first Ouranos, the sky, conceived as a covering enclosure and a firmament; then the tall and woody mountains, “the unharvested sea, seething with its swell”; and after Gaia lies with Ouranos, the Titans).

What the chaos in Chaos genet’ means is not altogether clear. On the one hand, Hesiod’s predication can be seen as describing an event: the abrupt coming into being of a gap in the undifferentiated all that inaugurates cosmogenesis, an opening wherein differentiation and generation (Eros) can take place. (In Blake’s imagery, “Eternity roll’d wide apart; / Wide asunder rolling,” revealing “An ocean of voidness unfathomable.”)<sup>4</sup>

Alternatively, Hesiod's chaos simply names a primal state, the boundless waste that precedes the differentiated world and persists in the Tartarean gulfs. In any case, chaos is not mere space, or the blank void of the atomists, or the absolute nothing from which something is created of the Christian apologists. But it is the unsubstantial precursor and enabling ground of what is—of what is substantial and permanent: the earth, “a firm seat of all things for ever,” and the sky, “a firm seat for the blessed gods.” And as such—as its etymology and annunciation suggest—it is imagined as a negative presence, a gap, a discontinuity in the blankness, a momentous something precisely because it is an instantiating hole in the absence of the solid, teeming, and various all.<sup>5</sup>

The Old Norse creation story in the Elder Edda, Voluspa (“The Prophecy of the Seeress,” late first millennium) begins things similarly, with a ginnunga-gap, a gaping hole in a potentiality best described negatively, by absence:

In earliest times did Ymir live:  
was nor sea nor land nor salty waves,  
neither earth was there nor upper heaven,  
but a gaping nothing, and green things nowhere.<sup>6</sup>

The Old Norse gap, English “gape” and “gap,” and Greek “chaos” rise from closely related Indo-European roots.<sup>7</sup> And the words seem to serve the same complex purpose in the Edda as in the Theogony, asserting an absence that verges on presence, with subliminal suggestions of a steep discontinuity, as in Milton's description of chaos as a “vast abrupt.”

The next stage in the Norse account is a more positive disorder:

From the south the sun, by the side of the moon,  
heaved his right hand over heaven's rim;  
the sun knew not what seat he had,  
the stars knew not what stead they held,  
the moon knew not what might she had.

(2–3)

At this point, to order things into a cosmos, the naming and shaping powers (the Mighty Gods) take a hand.

“Chaos” and “chasm,” from Greek through Latin, also link etymologically, and the King James Bible's familiar “great gulf fixed” between Lazarus and Dives, heaven and hell (Luke 16:26), appears in the Latin Vulgate and its Rheims translation as, “Between us and you there is fixed a great chaos.”<sup>8</sup> But absence, vacancy, as well as undifferentiated shapelessness or the condition of next-to-nothing are already in the account of the first chaos, the antecedent of the realized world as imagined in the opening verses of Genesis and in its interpretive tradition: “In the beginning God created the heaven and the earth. / And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters” (Gen. 1:1–2).

The Hebrew words rendered in the Authorized Version as “without form” and “void” (and as “a formless void” in the New Revised Standard Version) are *tohu* and *bohu*, whose reduplicative rhyme echoes in English and French words that suggest a chaos of sound. Though English hubbub and French *tohu-bohu* lend moral support to the suggestion in the



echoing Hebrew phrase of some cacophonous antitype to the creative and differentiating word of God, barren waste and emptiness are the chief burden of the phrase. As John Calvin noted of its principal terms:

The Hebrews use them when they designate anything empty and confused or vain, and nothing worth. Undoubtedly Moses placed them both in opposition to all those created objects which pertain to the form, the ornament and the perfection of the world. Were we now to take away, I say, from the earth all that God added after the time here alluded to, then we should have this rude and unpolished, or rather shapeless chaos. Therefore I regard what he immediately subjoins, that “darkness was upon the face of the abyss,” as a part of that same confused emptiness.<sup>9</sup>

Calvin adds that Moses refers to “the abyss and waters, since in that mass of matter nothing was solid or stable, nothing distinct.” Though this Mosaic chaos is not quite the absolute nothing that was God’s starting point in Calvin’s orthodox interpretation of the creation, it is not yet far removed.

The insistence in orthodox Christian apologetics and in mainstream Jewish interpretation on a creation *ex nihilo* reflects a divergence from less demanding views prominent in earlier thought.<sup>10</sup> Classical (ancient) physics and metaphysics long provided the main challenge to the notion that something could come of nothing, and “classical” modern physics, with its rigorous conservation laws for mass, energy, and other physical expressions within systems, took up the brief. (Contemporary physics, on the other hand, allowing of “vacuum fluctuations,” might find a good deal to say for the *ex nihilo* claim of the orthodox.)<sup>11</sup> Meanwhile, modern biblical scholarship, using linguistic, philological, and historical instruments, entered the argument concerning the meaning of the Mosaic text, and the interpretive issue is by no means laid to rest. Indeed, much recent scholarship and translation favor the view that Genesis begins with an adverbial phrase, as in “When in the beginning...” (a reading already in Rashi, eleventh century), and that therefore “without form, and void” may be read as a parenthetical description of an uncreated preexisting state. In E. A. Speiser’s modern rendering, the first sentence reads: “When God set about to create heaven and earth—the world being then a formless waste, with darkness over the seas and only an awesome wind sweeping over the water—God said, ‘Let there be light.’”<sup>12</sup> But this disambiguated reading has its vigorous opponents, on grammatical and other grounds. The Assyriologist Alexander Heidel, for example, besides asserting linguistic improbabilities, cites related biblical texts (mainly later) supporting creation from nothing. Among other passages, he cites Proverbs 8:23–24, where Wisdom declares, “I was set up from everlasting, from the beginning, or ever the earth was. When there were no depths, I was brought forth; when there were no fountains abounding with water,” and John 1:3: “All things were made by him and without him was not any thing made that was made.”<sup>13</sup>

The reading of Genesis that allows of preexistent matter of undetermined origins, perhaps coeternal, obviates some of the need for a metaphysics of nothing but only partly reduces the intimate connection of chaos with nothing. Whether as uncreated prior condition or as the initial stage of a creation *ex nihilo*, a chaos precedes the making of the cosmos in Genesis, and this chaos is imagined as shapeless, lightless, and empty, an abyss elaborated in the imagery of unfathomable waters and the rush of invisible, uncontained air.

The arguments over the intended meaning of Genesis sought resolution in comparative evidence from related or proximate cultures, evidence that—subject to interpretation—also

proves inconclusive. The text most pertinent for comparative purposes is that of the Babylonian creation epic, known by its Akkadian opening words as the Enuma Elish (“When on high”). The Enuma Elish begins with a primal chaos of inchoate waters that seem to have a female and a male aspect: Tiamat (like the Hebrew *tehom*, “the deep”), associated with the salt waters, and Apsu with the fresh. It is likely that their promiscuous commingling should be read as the primal condition, but quite conceivably it should be understood as the event that begins the generative process, for apart from their commingled waters, all else in the primal state is imagined and rendered in negatives:

When on high the heaven had not been named,  
Firm ground below had not been called by name,  
Naught but primordial Apsu, their begetter,  
(And) Mummu-Tiamat, she who bore them all,  
Their waters commingling as a single body;  
No reed hut had been matted, no marsh land had appeared,  
When no gods whatever had been brought into being,  
Uncalled by name, their destinies undetermined—  
Then it was that the gods were formed within them.<sup>14</sup>

In the subsequent narrative of events that precede the actual cosmic creation, Apsu, annoyed by the activity of the gods, decides to destroy them despite Tiamat’s maternal consternation. Instead, he himself is murdered. Tiamat, roused into revenge by some dissident gods, threatens to overwhelm the dominant lineage, who then put forth, as her supreme antagonist, the doubly endowed warrior god, Marduk. In defeat, Tiamat’s body furnishes the building material for Marduk’s cosmic architecture, his formation out of chaos of an ordered universe, numbered, measured, and compartmentalized, where each element and inhabitant has its place and boundaries.

The gendering in this conception of chaos and cosmos is of considerable imaginative interest, and so is the identification of the primal chaos with an abyss of waters. A worldwide motif, the primal waters appear in numerous cosmologies apart from the Hebrew and Babylonian, including Egyptian, Phoenician, in the Vedic literature, and among the Stoics, and in Thales, the first of the Ionian physical philosophers (seventh–sixth century B.C.), water is proposed as the universal ground of material being. Water—shapeless and protean, not to be compassed in reach and depth when gathered in the seas, unpredictable and uncontrollable in storm and flood, yet infinitely conformable in small amounts—has many natural claims on the imagination as a source not only of life but of figuration for the state of chaos, a state beyond direct experience and direct description. Turning the tables, when the seventeenth-century Dutch chemist J. B. van Helmont (d. 1644) was looking for a name for a new class of substances, formless when uncontained, often invisible, and however specific, somewhere in the scale between something and nothing, he went to the ancient poets and cosmographers for the word *gas* (Dutch *g* representing Greek *chi*), recognizing an affinity between these apparently dematerialized transformations of matter and the ancient chaos.<sup>15</sup>



The experience of disorder is of this world; extrapolations of disorder made absolute start from this world; the will to subsume indigestible phenomena (evils) in a comprehensive metaorder refers to this world. And serious thinkers and artists have not been content to confine chaos within the bounds of the near-unimaginable absence of this world. Rather they have reversed direction and read the negative presences and indeterminacies of the primal state into the mature creation, to characterize that creation's distance from an imagined perfection. These projections of an abiding chaos incorporate with the material world appear in classical thought and its inheritors in three guises: as space or the void, as recalcitrant matter or primary substance, and as motion or change (mutability, "strife," dissolution). In what now follows, I shall chiefly concern myself with the first two, roughly discriminated as "nothing" and "something." Strife, mutability, and dissolution will receive their due in later discussions. In some philosophers, the Greek atomists for example (Democritus, Epicurus), chaos persists in more than one aspect.

The claim for positive existence of the void in classical ontology comes to us fully articulated in the Latin of Lucretius's great philosophical poem, *On the Nature of Things* (before 55 B.C.). Inspired by the work and thought of Epicurus (d. 271 B.C.), its delineation of the harmonics of chaos reverberate in other aspects of its overview of the world we live in. Physically, the Lucretian universe is compounded of atoms and the void, and nothing else (1:432), and there is void (Lat. *inane*) in things as a necessary condition of motion and change. Place or space that is itself intangible, that is in itself "void" or "vacancy" (1:334), thus belongs not only to the primal precosmic state but is a fundamental constituent of the universe we know.<sup>16</sup>

Lucretius works from how things are back to their probable genesis, in keeping with a method that reasons from what the senses tell us. And therefore it is not until the fifth book of *The Nature of Things* that he describes at length the fortuitous beginnings of our world out of the innumerable accidental collisions and combinations of the primordia, the atoms, in the course of infinite time. At this point he requires the rhetoric of negative description. For at this point there occurs a momentous aberration, as chaos "swerves" from its regularity—its constant condition of distributed instability—into a chaos of the second degree:

Then, in these circumstances, was not to be seen the sun's wheel soaring aloft with generous light, nor the constellations of the great firmament, nor sea nor sky nor indeed earth nor air nor anything like to our things, but a sort of strange storm, all kinds of beginnings gathered together into a mass, while their discord, exciting war amongst them, made a confusion of intervals, courses, connexions, weights, blows, meetings, motions.

(5:432–439)

For evoking this special state of chaos, initiating the world of our experience but set off against it, Lucretius resorts to the characteristic imagery of war, meteorology, music untuned, mensuration denied, and kinetics. But he comes at all this through an evocation of what is not, or not yet: cosmos, astronomical, tetraelemental, and familiar. The rhetoric of negation then modulates into the tumultuous energy of the accreting mass that is chaos intensified. In this perhaps inevitable aberration from a steady-state chaos, the concentration into a mass implies a temporary increase in the "normal" ratio of atoms to void, but the void is far from absent; if it were, the mass would freeze into inertness.

Lucretius, following Epicurus, declares as a first principle (1:150) “that no thing is ever by divine power produced from nothing” (and supports it by demonstrating the absurdity of a hypothetical world subject to spontaneous generation). Similarly, he denies the possibility of a devolution to nothing. Matter is eternal and eternally recycled, though all things save only the indivisible primordia must suffer disruption and decay. His void is as essential to such disruption and decay as it is to growth and consolidation; that is, it is the gap, the absence, the discontinuity that, within objects and within the cosmos, enables change. It is not quite nothing, however, and Lucretius’s characterization replies to philosophical traditions that relegated such conceptions as space and vacancy to nonbeing. For Lucretius, the void is an absence of body but not an absence of being, and as far as possible he gives the void a status equal to that of his solid primordia. When he defines “whatever shall exist of itself”—all else being either properties or accidents of these—he carefully allows for the two kinds of being: that which acts or is acted upon by other things and that where “it will be possible that things be and be done in it” (1:440–443). As a nothing that is something, however, the void cannot be where body is, and it is not in that sense abstract space. Body and void must each necessarily exist, even within objects, “per se” and unmixed. “For wherever is empty space, which we call void, there no body is; further, where body maintains itself, there by no means exists empty space” (1:506–509). Both are the necessary components of a universe that, while infinite, is neither solid nor vacuous. Meanwhile, in enabling motion and change, it is void that sustains the legacy and potency of chaos within the orderly arrangements of the present world.

According to Aristotle and others, the Pythagoreans also held that the void exists and that it is drawn, moreover, into the ordered universe from “the unlimited” in the course of cosmic generation, as “a kind of separating and distinguishing factor between terms in series.”<sup>17</sup> Parmenides, however, in the early fifth century B.C., asserting the indivisible unity and fullness of being, denied any sort of discontinuity or vacancy, either generative or ontological. In his unitary conception there is no room for the void or any other negative or qualified form of being; indeed, the only path to truth available to thought is “that it is and cannot not-be...the other, that it is-not and needs must not-be, that I tell thee is a path altogether unthinkable.”<sup>18</sup>

Empedocles and Anaxagoras (mid-fifth century), though postulating a reality built up from elementary particles, adopted the Parmenidean view rejecting the notion of void on the eminently plausible grounds that as not-being it could not exist. To this proposition the atomists Leucippus and Democritus seem to have replied late in the fifth century with the theory of the full and the empty, the full imagined as particulate, existing in indivisible, finite, vanishingly small units with spaces in between. These are the views *mutatis mutandis* that then descend to Lucretius through Epicurus.<sup>19</sup>

A corollary of the atomists’ theory was that the primal chaos, all atoms and void, must itself be imperceptible, for only as the atoms cohere into structures do qualities available to the senses appear. And to the language logic with which their opponents demonstrated that the void as not-being could not exist Democritus countered with a language argument. From *meden*, one of the terms for the void, meaning “nothing, naught,” he coined the term *den*, for each individual atom, meaning “something,” or “aught.”<sup>20</sup> The effect of such clever

linguistic play was to enhance the ontological standing of the void, by the ingenious expedient of making the term for the solid component of the universe its derivative.

## “THE NURSE OF BECOMING”

Plato's *Timaeus* (ca. 360 B.C.), which the philosopher offers as a form of provisional truth, prominently includes a genesis and an antecedent chaos. Plato's principal concern, however, is to convey the nature of the world of becoming, the world we inhabit and experience. Accordingly, a strong critical tradition sees his Timaeian cosmogony as a consciously mythical device for laying out the complexities of the subsisting world of change.<sup>21</sup> In the dialogue, Plato threads his way between the cosmologies that incorporate a legacy of chaos as space or the void and those that locate the chaotic principle in the underlying stuff. Summarizing what he has so far maintained, *Timaeus* (it is he who projects these “probable” truths rather than Socrates) identifies the three kinds of existence that constitute and condition our world: the unchanging forms; their echoes or reflections, perceptible to sense and subject to becoming and perishing; and “Space [*xoras*], which is everlasting, not admitting of destruction; providing a situation for all things that come into being, but itself apprehended without the senses by a sort of bastard reasoning” (52a–b). It is in this third kind that the material copies of the unchanging forms must enter the actual, “clinging in some sort to existence on pain of being nothing at all” (52c). But space, which, with being and becoming existed “even before the Heaven came into being,” is not simply a three-dimensional void; it is the wherewithal out of which the visible world is constituted. It is, in Plato's phrase, “the nurse of Becoming,” which, “being made watery and fiery and receiving the characters of earth and air, and qualified by all the other affections that go with these, had every sort of diverse appearance to the sight” (52d–e). Now given elemental expression and character, this “nurse of Becoming” appears as a chaos of elemental forms and materials in motion, a sort of unstable phantasmagoria of becoming, accreting and dissipating, agitated, unbalanced, “in a state devoid of reason or measure.”<sup>22</sup>

What Plato suggests is that the sensible world, the world of objects and qualities, is to be understood as a (temporary) condition of space, a structure or a proportionality not in but of “the nurse of Becoming.” Consequently, “the mother and Receptacle of what has come to be visible and otherwise sensible must not be called earth or air or fire or water, nor any of their compounds or components; but we shall not be deceived if we call it a nature invisible and characterless, all-receiving, partaking in some very puzzling way of the intelligible and very hard to apprehend” (51a–b). A view that sees the physical world as conditioned space offers much that is compatible with the world of relativity, not to mention the quantum-mechanical approach to the structure of matter.<sup>23</sup>

In the *Timaeus* and elsewhere in Plato, it is clear that the primary stuff out of which the sensible, physical universe is worked has a certain intrinsic recalcitrance, or limitation, which causes the product to fall short of perfection. In the *Timaeus* this recalcitrance is identified with “necessity” (*Ananke*), a potential source of confusion for those prepared by later philosophic and scientific traditions to identify necessity with rigorous causality or physical

laws and so with order rather than disorder. Locating the principle of disorder in the stuff of the physical universe, in something whose necessary recalcitrance or even positive antipathy to form and spirit accounts for the sorry state of things and their relentless mutability, is a habit of mind—Manichaeism is the most convenient label—that appears in many cultures and in the thought of some of Plato's followers. Plato himself encourages some of its cruder manifestations, for example in his account of the migration of souls, a fable that reinforces the notion of the inherent persistence of chaos in the dualism of the constituted world. In this Timaeus fable, each soul is assigned to a star, and all start off equal, as men. If they master bodies and passions, they return to a heavenly abode and are blessed; if not, they are transmuted downward—first into women, then into animals, or less—until the soul manages to bring under control the microcosmic chaos, “the burdensome mass” of fire, water, earth, and air, “a mass tumultuous and irrational,” and so may return to its first and best state (42c–d). In broader terms, identifying recalcitrant matter with the primal disorder means that positive presence is united antithetically with negative ethos. As a result, the material and sensible is explained as being—by “necessity”—somehow less there, as defective in its quality or fullness of being, as dilute, or illusory, or as scarcely more in its presence than embodied absence.

The physical philosophers who preceded Plato, while unfurnished with his ingenious dematerialization of the primal stuff, nevertheless had sought to frame their conceptions to take account of the temporality and mutability connecting being to nonbeing in the natural world, to take account of the blatant discords, the instability, and the bewildering multiplicity. As we shall see (in [chapter 3](#)), there is a threshold in the encounter with multiplicity on whose far side either the senses or the mind's capacity for unsorted difference are overwhelmed. Beyond the threshold, endless diversity fills the void with a chaos opposite to nothing's homogeneity. To manage this chaos of the many, Parmenides and his camp postulated the One. The physical philosophers found other means, including a judicious admixture of negation, to temper the diversity.

Thales with water, and his successors with other “elements,” found an alternative solution to the problem of the many by identifying a primary substance of which everything else could be understood as a transformation. Anaximander went further (or deeper) by imagining a material principle that underlay all the plausible elements and thus escaped the limitations of a fixed elemental character. He called this primal substance the *apeiron*, the unlimited, a term that succeeds wonderfully in achieving a concentrated blankness of the greatest generality. Anaximander's pupil or associate, Anaximanes, sought a fundamental substance with at least some character and definition in its primary state and turned to air, and while unwilling to qualify the One with discontinuity, or nothing, he introduced a principle of condensation and rarefaction to account for the other elements, which did just as well. Heraclitus on the other hand turned to the volatility of fire, but the vestiges of chaos in what can be conjectured of his remarkable system lie elsewhere than in a notion of characterless or maximally attenuated being.<sup>24</sup>

Aristotle found much to complain of in Anaximander's *apeiron*. But he too found it convenient to treat the material principle as—in the words of Werner Heisenberg—“a kind of indefinite corporeal substratum, embodying the possibility of passing over into actuality

by means of the form.”<sup>25</sup> In the biological model that proved especially fruitful for Aristotle, actualization was a process of unfolding according to an intrinsic blueprint that, embryonically at least, held out the promise of perfection. It was in the nature of things, and in their dependence on matter, that the actualization fell short of the entelechy. As later millennia would see it, the world slips from its unfallen potential and suffers the irregularities of weather, accident, disease, and an inclined axis, by virtue of the intrinsic unruliness of the material principle, the vestiges of chaos. The flesh is weak.

## SAYING NOTHING

Once he had returned to full circulation in the West, Ovid became, along with Genesis, the most important purveyor of imagery evoking the primal chaos to the postclassical world. It was his depiction of chaos in the *Metamorphoses* (ca. 8 A.D.), in a description laden with the rhetoric of negation, that carried classical chaos into the visual and textual imagination of the Middle Ages and after (fig. 1.1). Such a rhetoric of negation has been remarked so far in the *Rig Veda* (“There was no nonexistent and there [was] no existent at that time...”), the *Enuma Elish* (“When on high the heaven had not been named...”), the *Elder Edda* (“There was neither sand nor sea nor the cold waves...”), and in Lucretius’s *On the Nature of Things* (“Then...was not to be seen the sun’s wheel soaring aloft with generous light...”). It is common enough in descriptive poetry to be recognized as the method of first resort. A prime instance is the *Sieur Du Bartas*’s prolix catalogue in his ambitious poem on the creation and early history of the world, the *Divine Weeks* (1578/1584). Du Bartas uses an enumerative rhetoric of negation and is fond of the builder’s metaphor. He points out, in all orthodoxy, that the divine architect began his work with neither preexistent models from which to steal nor convenient raw materials. Rather:

Nothing, but Nothing had the Lord Almighty,  
Whereof, wherewith, whereby to build this Citie.<sup>26</sup>

His first act as a builder—now, like a master shipwright—is to make provision of materials and heap them up at the ready. Meanwhile,

That first World (yet) was a most form-lesse Forme,  
A confus’d Heape, a Chaos most difforme,  
A Gulph of Gulphes, a Body ill compact,  
An ugly medly, where all difference lackt.

(ll. 247–250)

Uncontrolled promiscuous mingling and elemental war combine to form one representational trope for this unshaped “Embryon” of the world; unvarnished negative description provides another:

All, All was void of beauty, rule, and light;  
All without fashion, soule, and motion, quite.  
Fire was no fire, the water was not water,



Aire was no aire, the Earth no earthly matter:  
Or if one could in such a World spie forth  
The fire, the ayre, the water, and the Earth;  
Th' Earth was not firme, the fire was not hot,  
Th' aire was not light, the water cooled not:  
Briefly, suppose an Earth, poore, naked, vaine,  
All void of verdure, without Hill or Plaine,  
A Heav'n un-hang'd, un-turning, un-transparant,  
Un-garnished, un-guilt with Starres apparant,  
So maist thou guesse what Heav'n and Earth was that,  
Where, in confusion raigned such debate.  
A Heav'n and Earth for my base stile most fit,  
Not as they were, but as they were not yet.

(ll. 269–284)

In his concluding modesty, the poet does some unintentional injustice to Ovid, whose similar account in *Metamorphoses* of the prior state that “men called Chaos” furnished Du Bartas with a model, the sort of thing the divine architect did without.

In Ovid's great treasure-house of a poem, the ordering of the world out of chaos is the first “metamorphosis.” As in Du Bartas, his account joined negative description, amplified and enumerated, with elemental strife:

Before the sea was, and the lands, and the sky that hangs over all, the face of Nature showed alike in her whole round, which state have men called chaos: a rough, unordered mass of things [rudis indigestaque moles], nothing at all save lifeless bulk and warring seeds of ill-matched elements heaped in one. No sun as yet shone forth upon the world, nor did the waxing moon renew her slender horns; not yet did the earth hang poised by her own weight in the circumambient air, nor had the ocean stretched her arms along the far reaches of the lands. And, though there was both land and sea and air, no one could tread that land, or swim that sea; and the air was dark. No form of things remained the same; all objects were at odds, for within one body cold things strove with hot, and moist with dry, soft things with hard, things having weight with weightless things.<sup>27</sup>

Ovid's overall account shows signs of wishing to reconcile a variety of philosophic views if not in cosmic then in verbal and aesthetic harmony. He aims at a view that will be generally acceptable in its consolidation of some of the then standard thinking on the subject, and it is worth noting that his chaos has much in common with the Lucretian description of universal disorder after the “swerve,” including its catalogue of negatives. It is Ovid's imagery and phrasing, however, that will turn up time and again in later ages.

## NOTHING AS NOTHING

Once the Christian world took seriously the notion of creation ex nihilo, it had to wrestle with the paradoxical reality and nullity of nothing. The conceptual difficulties are vividly framed in a sermon preached in 1622 by the churchman and poet John Donne. He confesses that “The drowning of the first world, and the repairing that again; the burning of this world, and establishing another in heaven, do not so much strain a mans Reason, as the Creation, a Creation of all out of nothing.” The less anything is, Donne says, the less we know it; “how invisible, how inintelligible a thing then, is this Nothing!” We know things by what they have done, he argues, even when it comes to God, but as for this Nothing, “what hath that



done?” Immense things can come from very little—a Leviathan from a grain of spawn, a mighty oak from a buried acorn, a man from nothing to a great estate—“but that Nothing is but nothing in comparison” since “absolutely nothing, meerly nothing, is more incomprehensible than any thing, than all things together. It is a state (if a man may call it a state) that the Devil himself in the midst of his torments, cannot wish.”<sup>28</sup>

The struggle had its rewards. Already in Augustine, the ability to apply a developed sense of nothing to fundamental metaphysical and theological issues (such as the negativity of evil) proved a godsend. In theology, concerned with the nature and knowability of God, an alternative to positive definition—inescapably limiting—proved invaluable. But nothing as an aspect of the physical creation, with ties to the primal absence or the formless void, continued to present a problem. It was perhaps specially awkward for those in the Middle Ages influenced by Aristotelian thinking, given his notorious discountenancing of both a void and a beginning, a primal discontinuity such as Plato had envisaged in the *Timaeus* and Christian orthodoxy found in *Genesis*.

One of those who attempted to cope in the climate of a new age was Charles de Bouelles (Carolus Bovillus), who in 1509 finished his *Liber* (or *Libellus*) *de nichilo*, a treatise on nothing. Among the series of propositions he offered are these:

1. Nothing is nothing.
2. Matter is near to and nearly nothing: yet it is not nothing.
3. Matter is the middle term between being and nothing.
4. Nothing has less being than matter [is less of a being?]
5. Out of nothing nothing comes.<sup>29</sup>

According to Bouelles, in matter both the positive and the negative meet, but he is not satisfied with a simple linear scale. He shows, for example, in a schematic chart, that the negation of nothing is potential being. In the play of syntactic paradox that negative abstraction facilitates, Bouelles attempts to resolve the contradiction between Christian creation and classical conservation, the latter appearing in two further propositions: “6. Nothing passes into nothing. 7. Nothing new arises; nothing perishes.” At the head of his text is a powerful image of God creating the universe out of nothing: God holding in his hands a thick ring of black and breathing life through a tube that penetrates and traverses this nothing into a smaller circle that contains all the six days’ work of Creation ([fig. 2.2](#)). Bouelles argues that since God is of an indivisible and integral substance, he in the act of creation necessarily brought forth nothing, and from nothing he created the universe. Bouelles attempts to resolve the problem of conservation by arguing—with much mathematical play on the finite and the infinite, zero and infinity—that in relation to God everything created is as nothing and nonbeing, and in that sense the principle is maintained: a conservation of nothing in the everything.



FIGURE 2.2. Deus de Nichilo Creans Universa, illustrating Charles de Bouelles, Liber de nichilo (1510).

Source: Columbia University Library.

Representing chaos in language through negative description and subtractive enumeration lent itself to ingenious paradox and open-ended flights of fancy. But when it came to the nonverbal arts, the resources for negative evocation, for representing chaos as what is not, were markedly less fertile. In sound, for example, nothing is best served by silence (though arguably dissonance, deformation, and cacophony can be considered subtractive, and John Cage's 4'33" does manage a condition between nothing and something, as I shall suggest later on). Similarly, on canvas, or paper, or panel, or plaster, the most effective representational choice would seem to lie between blankness or blackness. Just five years before John Donne's sermon on the difficulties of imagining the nothing that became the world, the early modern physician and hermetic philosopher Robert Fludd, in a syncretic exposition of the macrocosm, postulated as a first antecosmic condition a primordial Ens without limits or attributes, "without quantity or dimension since one can speak of neither small nor large; without qualities, neither rarified nor compact, imperceptible; without properties or tendencies, neither moving nor still, without any color or elemental characteristics; passive initially, yet capable of all actions and [of becoming] all things."<sup>30</sup> After so much and more, Fludd offers its visual representation: a solid black

square with, along each of its four sides, the inscription *Et sic in infinitum*—“And so on to infinity” (fig. 2.3a.).<sup>31</sup> Fludd further illustrates a transition to cosmos as passing through a series of spectacular phases, including a diametrically opposite version of chaos, a disordered elemental everything. First, however, we see an inflationary diffusion of light (as of pure intelligence) from a dark unknowable center, whose rays lighten as they radiate, with a fringe (to borrow language from Big Bang theory) of “density perturbations” at the bubble circumference, expanding symmetrically into the void (fig. 2.3.). (In a later variant, the dove that represents the Holy Spirit blazes a circular trail of light at the command of the frame-breaking, cloud-hidden Word, irradiating and dividing the surrounding darkness [fig. 2.3c.].) After a further image showing what has now become the four elemental essences in concentric array, still in appearance expanding into the darkness, we see them in their material form chaotically jumbled, if not actually at war, with hot fighting cold, and wet dry. But this more material and conventional chaos has its subtle visual patterning, and falling within the outlines of a soon to be stratified cosmos, it is now set against a white, empty background (fig. 2.3d.). In the shifting imagery of Fludd’s verbal account, the dark latency—passive, formless, and insubstantial until irradiated—becomes the “world mother” in whose lap, beneath the ether, the grosser elements are suspended and, as in the womb, contained (25).

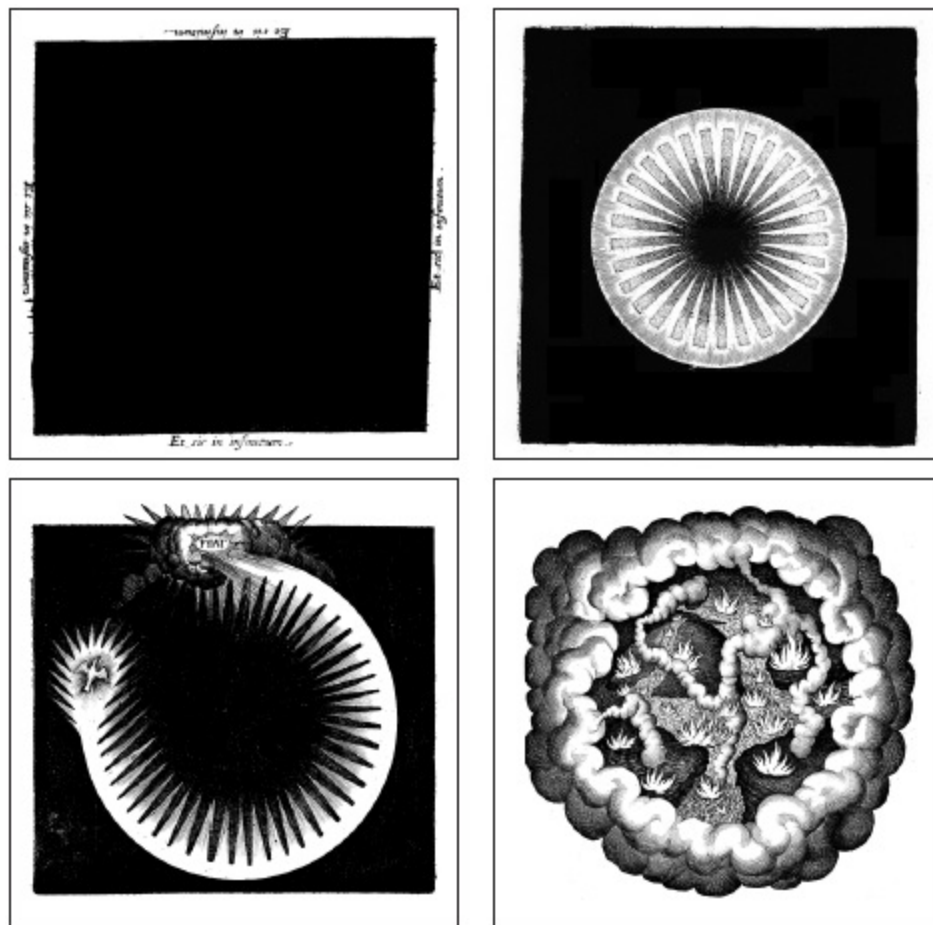


FIGURE 2.3.A.–FIGURE 2.3.D. Robert Fludd, *Utriusque cosmi maioris silicet et minoris metaphysica, physica atque technica historia* (Frankfurt, 1617), illustrations.

Source: By permission of the Folger Shakespeare Library. Shelfmark BD500.F4 1617a Cage. a. *Et sic in Infinitum*, p. 26. b. [Creation], p. 29. c. *Fiat Lux*, p. 41. d. [Elemental Chaos], p. 49.

## THE MIDDLE OF NOWHERE

The history of the idea of nothing is not our business here but rather the imagination of chaos, of ultimate incoherence, as nothing. Concepts and images, however, live a life of their own, seek to replicate themselves in other habitats, adapting, assimilating, and often altering their new environs as they go. Absence and void, still trailing vestiges of the primal chaos, thus claimed a place in thought about a God who was both the universal ground of being and the creator of all that is. Thus, in the matter of the Creation, absence and void as a prior condition, a gap to be filled, offered a challenge to the notion of absolute and unlimited Being, a difficulty overcome most enigmatically in the Doctrine of Emanation, whereby—as Meister Eckhart would have it (ca. 1300)—the nothing of the world is sustained from moment to moment by its being in God, acting in a realm prior to and beyond “the positivity of being.”<sup>32</sup> There was also a simpler, physical rather than metaphysical challenge, one that took up themes from classical natural philosophy concerning the materiality of space and the possibility of the void (that is, of space exhausted of everything else). The philosopher, natural and otherwise, who effectively disposed of the hoary notion that nature will not permit a vacuum was Blaise Pascal, and Pascal marks a major turn in the story.

Pascal’s achievement as far as the void was concerned was to separate decisively the physical issue from the metaphysical issue. René Descartes, in the wake of the ongoing revolution in astronomy, had already accepted a universe of infinite extension, but, arguing the codependency of space and matter, had dismissed the possibility of a void. Pascal’s *New Experiments Concerning the Void* (1647) rejects that argument, refutes the received idea of nature’s abhorrence of the vacuum, and in so doing releases the imagination of emptiness and its terrors into the physical world. That is, he naturalizes an inner experience of vertigo and subjective annihilation heretofore more likely to be evoked by the incomprehensible obscurity and ineffability of the Godhead.

Pascal’s memorable reflections on our situation in the universe in the *Pensées*, “between these two abysses of the infinite and (the) nothing,”<sup>33</sup> projects a nature that is neither animate nor sensitive, that is imagined abstractly, but is nevertheless fraught with affect whose intensity is a function of the thinking subject’s isolation and centrality. What is at stake is our most elemental and intimate sense of being. Descartes had been able to claim immunity even against a deceiving, ever-negating infernal spirit: “he will never manage to turn me into nothing, as long as I think that I am something.”<sup>34</sup> But Pascal undercuts that security by giving over to the threat of annihilation the hard-won finite outlines of our bodily sense of self, the intimate space where thought and the thinker are peculiarly at one. The nature that Pascal claims we initially constitute out of our reasonings on number, time, and dimensionality he subjects to the mathematical ideas of unity, infinity, and nothing, problematizing position and scale. Now in the physical world, too, the midpoint in an infinite scale may be anywhere or nowhere—and worse, “the unit [for example, Pascal] adjoined to the infinite adds nothing to it...in the presence of the infinite the finite is annihilated and becomes pure nothing.”<sup>35</sup>

The existence of man in the realm of nature, between the infinite and the infinitesimal, is



a mean very like that which Pascal uses to characterize the ontology of the vacuum. He concludes “that there is as much difference between nothingness and empty space as between empty space and material body; and that thus empty space holds the mean between matter and nothingness.”<sup>36</sup> But presumably empty space cannot feel its condition or the vertigo of a calculus that unfixes the midpoint from its coordinates and sends it hurtling toward nothing. There is no inner space to the vacuum and nothing to remark that “the eternal silence of these infinite spaces makes me afraid” (*Pensées* 187, p. 615).

With Pascal having put the matter of the void once more on a scientific basis, having given autonomous standing to the immensities and absences of the physical creation, to infinity and nothing and to the solitary experience of the abyss, the spiritual logic of the *via negativa* is broken. It becomes neither the argument for the necessity of God nor a dialectical path to categorical transcendence but an argument that is contingent and prudential. It becomes a bet in the dark. “God is, or He is not; but to which side should we incline? Reason can determine nothing here. There is an infinite chaos which separates us.” (*Pensées* 397, p. 677). On the loose in the universe, we are free to experience the absence, the deep obscurity, the lostness, the vertigo of the abyss, on our own. “We wander over a vast milieu, ever drifting and uncertain” (*Pensées* 185, p. 612). No longer forcing the issue of God (but one can still bet to maximize advantage), the vertigo that comes from looking over the edge into an infinite nothingness has an independent foundation in physical reality, though in the end the purely subjective experience, the experience of the abyss within, overwhelms and absorbs its external, physical correlative.

Or so it was among Pascal’s spiritual children. Pascal’s liberation of the void into unfixed subjectivity bore fruit in the poetry and poetics of the nineteenth century. In the middle of that century, Baudelaire, always alert to a kindred spirit, makes the connection explicit in his sonnet “Le Gouffre” (gulf, chasm, abyss):

Pascal had his gouffre, moving with him.  
—Alas! all is abyss,—act, desire, dream,  
Word! And often, on my pelt that stands on end  
I feel the passing wind of Fear.

Finding it “high and low, everywhere, the depths, the shore,” beset by silence, space, the nightmare of endlessness, seeing only the infinite through every window, fearful of sleep as of “a great hole,” haunted by incessant vertigo, the poet despairs of ever escaping, from “Numbers and Beings,” into the enviable insensibility of “nothing.”<sup>37</sup>

The peace to be found only in nothingness echoes the cry of a fellow traveler on the road of excess, Georg Büchner’s Danton, in the play *Danton’s Death* (1837). Büchner’s political tragedy, set in the vertiginous chaos of the French Revolution but written in a climate of failed aspirations and sclerotic and oppressive regimes, gives voice, in its title character, to an existential anguish and emotional depletion no longer able to come to terms with a revolution bloated with words and devouring its own. In the prison of the Conciergerie, Danton invokes the thought of an asylum in nothingness and eventually deconstructs it. When told by his fellow prisoner, Philippeau, that the peace he wants is in God, he replies, “Im Nichts”—in nothing. And he continues, if supreme peace is God, then

nothing must be God. But there is a catch. In a remarkable flight of intricate negation, he amends his nihilistic argument:

However, I am an atheist. That accursed precept: something cannot become nothing! and I am something, there's the misery!

Creation has spread itself so wide, that there is no emptiness, everything swarms to the full.

Nothing has murdered itself, creation is its wound, we are its drops of blood, the world is the grave in which it rots.<sup>38</sup>

(III, vii)

Hesiod's Chaos genet', that gap which the creation then fills, is here reimagined with revulsion, as a suicide, as wound, as rot, the womb reconceived as the grave. Near the end, Philippeau offers an anodyne theodicy as consolation: that from a little distance above the earth, "all the chaotic wavering and glimmering are lost to sight, and a few great and godly outlines fill one's eyes" (IV, v). As the transport to the guillotine is announced, Danton caps the collective derision with a judgment and summation, one that pointedly reverses the order of creation in the great positive cosmogonies: "The world is chaos. Nothingness is the world-god waiting to be born."

## POSITIVE NEGATION

Modern criticism has pursued this romance with annihilation with much verve and enthusiasm—Robert M. Adams, for example, does so in *Nil: Episodes in the Literary Conquest of the Void in the Nineteenth Century*. Adams is at his best dealing with those writers, many in a Catholic tradition, coping with an inner void and an outer absence and with the abyss of subjectivity itself, such as Leopardi and Mallarmé. Other writers, such as Melville and Zola, are perhaps better understood as among those for whom chaotic negation was bound up with energy on the one hand and entropy on the other, as I shall argue later on. For now, however, I shall only touch upon a few thinkers and writers, some armed with fresh means and perspectives, who represent the nineteenth century's notable campaign to strip nothing of its nullity or to bring negation back into the fold of a dynamic order.

In a note to *The Dialectics of Nature*, Friedrich Engels quotes Hegel's generalization that "the nothing of a something is a determinate nothing," a remark that goes far to tame the terror of the negative principle as a limitless abyss of nullity. Such is the character of Mephistopheles in the first part of Goethe's *Faust* (1808). "The spirit which eternally denies," as he names himself, gives an account of his dialectical evolution into the vigorous figure he cuts in the drama: the differentiated spirit of negation in a dynamic world. In a well-known, soberly enigmatic passage, he declares:

I am part of the part that once was everything,  
A part of the selfsame Dark that bore the Light,  
The haughty light that now disputes  
Her ancient rank and Raum with Mother Night.<sup>39</sup>



Commendably combative (even God approves the dialectical challenge to His positive creation, as stirring things up), Mephistopheles claims as his element “everything that you call Sin, Destruction—Evil” (ll. 1342–1344). Now the energy of negation, the “part” he is part of was once all and nothing, a chaos neither positive nor negative (like zero). Through parturition with positive issue, this primal matrix has been redefined and reborn as a determinate negative complement, the nothing of a something. Mephistopheles, “the egregious son of Chaos!” (l. 1384), is now only the dark that knows itself by light, the active, envious brother to what is.

In part 2 of *Faust*—completed just short of Goethe’s death in 1832—Goethe makes another pass at the primal chaos that lies beneath and behind the world, as a matrix of becoming. He no longer imagines it as temporally distanced, as what once was, before the beginning, but as a timeless, ongoing cauldron of creation and recreation, formation and transformation: an expression of flux and vacancy figured in the imagery of the negative sublime. Faust, required to produce the visible form of Helen of Troy, is reluctantly steered by Mephistopheles to the Mothers, goddesses enthroned high in solitude where “No place contains them, still less a time.” To reach their unreachable dwelling place, “you must mine the abyss.” There are no gates or barriers in the way—only *Oed und Einsamkeit*, emptiness and solitude. Mephistopheles contrasts the only seemingly limitless, borderless character of ocean and space—always there is something—but:

Nothing will you see in that eternal, distant void,  
Nothing hear when you take a step; find  
Nothing solid to rest yourself upon.

(ll. 6246–6248)

Faust replies that Mephistopheles speaks to him like the peddlers of mystical nonsense, “but in reverse; you send me into the void.” Nevertheless, he takes up the challenge, for “In your Nothing I hope to find the All.”

Engels, needless to say, argues for the positive force of negation and, more fundamentally, for its relativity as negation. Unveiled, it presents the new face of reality. He also has something positive to say for the zero point. He quotes Hegel’s axiom on negatives in a disquisition on the number zero, which, “because it is the negation of any definite quantity, is not therefore devoid of content.” On the contrary, “zero has a very definite content. As the border line between all positive and negative magnitudes, as the sole really neutral number, which can be neither positive nor negative, it is not only a very definite number, but also in itself more important than all the other numbers marked off from it. In fact, zero is richer in content than any other number.”<sup>40</sup> Engels goes on to note the effects of zero in multiplication and division, where it uniquely “stands in a relation of infinity to every other number”; its applications in geometry, mechanics, and molecular motion and heat, where it “in no way represents pure abstract negation, but a very definite state of matter”; and its immense importance—eclipsing that of the magnitudes marked off from it—as a limit. Like the Lucretian void, it is necessary to the constitution of a universe. It conditions movement and supplies the ground of change.

Finally, in a reaction that rehabilitates the Cartesian plenum, Bergson takes up “the idea

of ‘Nothing’” in the fourth chapter of *Creative Evolution* only to negate it, along with the concept of disorder itself—chaos, negative or positive—as products of an unfortunate but corrigible habit of mind. Like the idea of disorder with which it is intimately twinned, “Nothing” answers to “the static habits of the intellect.” Bergson locates the fundamental error in the notion that “order fills a void” (or was imposed upon a prior absence of order) and “in the radically false conception which it implies of negation, of the void and of the nought.” Where philosophy goes astray is in operating on the implicit question, “Why is there something rather than nothing?”<sup>41</sup> From such a beleaguered position,

Existence appears to me like a conquest over nought. I say to myself that there might be, that indeed there ought to be, nothing, and then I wonder that there is something. Or I represent all reality extended on nothing as on a carpet: at first was nothing, and being has come by super-addition to it. Or, yet again, if something has always existed, nothing must always have served as its substratum or receptacle, and is therefore eternally prior.

(276)

Bergson dismantles this “pseudo-idea” less through physical or metaphysical than through psychological argument. Like others before him, he asserts the sheer impossibility of imagining or conceiving “Nothing,” in particular by subtraction. When all that belongs to the external world is extinguished, inner sensations and self-awareness are still present. When imagining a further extinction, including consciousness, another consciousness external to the self is necessarily created. “I can by turns imagine a nought of external perception or a nought of internal perception, but not both at once.” And in the midst of mere oscillation, “the image of ‘Nothing’ is formed” (279).

Bergson postulates that an intelligent being without memory or expectation would not use the words “void” or “nought” but would express only what is and is perceived. He also argues that negation is “an affirmation of the second degree” and that latent in all negations is the implicit affirmation of an alternative something, whereby—parasitically—“this phantom objectifies itself.” Through accretion and generalization, “We thus obtain the idea of absolute Nothing. If we now analyze this idea of Nothing, we find that it is, at bottom, the idea of Everything” (296).

\* \* \*

Positive negation that embraces chaos is a notion to be reckoned with, from the revolutionary rhetoric of Saint-Just at the dawn of the romantic century to the bromide of “creative destruction” in our own. But negation is a dangerous animal, prone to bite those who let it loose, and its ultimate product, played backward or forward, as origin or destination, is nothing. From negation, nothing gets its energy and its fungibility with chaos. For in such case—as a character points out in one of the brilliant cyberfictions of the Polish writer Stanislaw Lem—“Nothing [Nic]...is not your run-of-the-mill nothing, the result of idleness and inactivity, but dynamic, aggressive Nothingness [Nicosc], that is to say, perfect, unique, ubiquitous, in other words Nonexistence [Niebyt], ultimate and supreme, in its very own nonperson!” Lem’s story, called “How the World Was Saved,” a parable for our time, purports to explain how “to this day the world has remained honeycombed with nothingness.”<sup>42</sup> And in a dazzling sleight-of-hand conflation of word and thing, object and

representation, it turns the negative route to the representation of chaos, as practiced in language, into a poignant and hilarious cosmic joke. As the blameless executor of the newly prevailing condition points out, reproachfully: “Take a good look at this world, how riddled it is with huge, gaping holes, how full of Nothingness, the Nothingness that fills the bottomless void between the stars, how everything about us has become lined with it, how darkly it lurks behind each shred of matter” (7).

The speaker is a machine able to create anything that starts with the letter n, invented by Trurl the Constructor. When put to the test by Trurl’s envious and disparaging friend Klapaucius, the machine is eventually instructed to do (which, as in many languages, is also to make) nothing, and—now with the fearful power of negation—it quietly begins removing things from the world. It starts in the familiar range of n-initialed things but soon gets on to everything else. At moments, with the loss of quasi-negatives, like nonconformists, nonentities, nonsense, neglect, it appears that the world is improving, but very soon it seems to be thinning out. When stopped short, by a minute or so, of achieving universal nothingness, the machine is able to restore those missing n-initialed things but not the many losses in the other letters, like “gruncheons,” “pritons,” and “the gentle zits.” And so the universe is left with its gaping, arbitrary absences, its dark and pervasive lining of nothingness. “This is your work, envious one,” says the machine to Klapaucius with a Faustian resonance. “And I hardly think future generations will bless you for it.”<sup>43</sup>

Like its ancestor in “The Sorcerer’s Apprentice,” Trurl’s machine, following the rigorous logic of its program, upsets the order of its universe, making for chaos. It does so by making nothing, reversing the cosmogonist’s well-worn path from chaos/nothing to cosmos. Brought to a halt in mid-act, it leaves us with something close to our present universe, somewhere between cosmos and chaos, worm-eaten with nothingness.

Yet—however unsettling the idea of making nothing (programmed annihilation writ large)—stretching the logic of everyday in accounting for the relations between nothing and something was not exactly new in contemplating the being and becoming of the universe. As we have seen, both as the background of creation and as a dialectical presence within it, chaotic nothingness suffered an erratic and paradoxical career in Western thought and imagination: not simply as antithetical to cosmos but as antithetical to being, as the shadow of being and as the enabling ground of becoming, as reified void and as subjective abyss, as a mere idol of the cave and as ultimate reality. Much simpler—or so it would seem—would be to avoid the negative route and the intellectual maze of chaotic nothingness and begin with matter more substantial, with matter we know how to deal with, matter subject—as the biblical Wisdom of Solomon has it (11:20)—to “measure and number, and weight.”

# NUMBER

## THE ONE AND THE MANY

Quantity creates innumerability, endless multiplicity—quality brings unity to the chaos.

—Novalis, *Vermischte Bemerkungen*

**N**egation provides an effective strategy for the representation of chaos, but conceptualizing the limiting extreme of disorder as nothing leads back into the labyrinth of the unimaginable. The paradoxical task of representing nothing entails at least as much obliquity as the original task of representing chaos. Suppose then one were to begin and end with a something?

When the extreme of disorder is poised against a something, the resulting configuration has a linear simplicity, with chaos (or nothing) at one end of the scale and cosmos at the other. When the extreme of disorder is conceived as a state of something, then chaos is bimodal. That is, it can be thought of either as a condition of extreme simplicity, undifferentiated to the point of virtual homogeneity, or as a condition of unlimited plurality and diversity. It can appear as the one or the many.

Two sets of parables illuminate this difference. The first set is to be found in Genesis, a text that purports to offer not only retrospective description but causal explanation. The second is a short animated film, Zbigniew Rybczynski's *Tango*.<sup>1</sup> The first set, a pair of linked narratives, offers flatly contradictory models for the transitions between chaos and cosmos, cosmos and chaos. The second, a single integral document, brings into play the subjective: the perceptual and cognitive dimensions of the experience of chaos. Bridging the ancient Near East and *Tango*'s modernity, bridging the spheres of action and cognition, are the Greeks of the age of Sophocles, who inherited and transmitted a strong identification of cosmos with number. Accordingly, the apparent failure of number, a flaw in its logic, an incongruence between that logic and the evidence of fact and experience, could in their world stand for the revealed face of a chaos at the heart of things. It is this disposition in Greek thought that undergirds the chief parable for the representation of number-governed chaos in what follows: Sophocles' tragedy of *Oedipus Tyrannus*.

## DIVISION AND MULTIPLICATION

In Genesis as in many cosmogonies, the path that leads to cosmos from the featureless and amorphous primal state is division and multiplication, whose consequence is proliferating differentiation. The so-called priestly redactor of the opening section tells how—amid the prevailing abysmal darkness and confusion—God made light and divided the

light from the darkness. Having so also initiated a differentiable succession of “days,” he further divides the waters above from the waters below with a “firmament,” distinguishes heaven and earth, the seas from the dry land, and even the vegetable kingdom in all its variety from the ground that brings it forth. By setting lights in the firmament to further differentiate the day from the night, he creates calendar time, distinguishing by these heavenly signs seasons and years as well as days. On the fifth and sixth days, he furthers the work of speciation in the seas, on land, and in the air, in passages that stress the abundance, the variety and multiplicity, of the fully realized and freshly created world. His culminating act is to multiply his own image in a dual form—male and female—marked by complementarity and difference and to set all in a licensed order based on the food chain.<sup>2</sup>

The nature of the transition from chaos to cosmos is carried in the language of representation, that is, by way of diction, syntax, and style. Language is the means whereby the reported acts are effected, not simply the medium through which they are transmitted. Robert Alter, the contemporary critic who has attended most fruitfully to the poetics of the biblical text, points out how the poet’s vision is expressed in stylistic and conceptual symmetries in which “each moment of creation is conceived as a balancing of opposites or a bifurcation producing difference in some particular category of existence. In the first half of Chapter 1, the governing verb, after the reiterated verbs of God’s speaking, is ‘to divide,’ suggesting that the writer was quite aware of defining creation as a series of bifurcations or splittings-off.”<sup>3</sup> At the same time, “Everything is numerically ordered; creation proceeds through a rhythmic process of incremental repetition; each day begins with God’s world-making utterance (‘And God said...’) and ends with [a] formal refrain.” It is not simply differentiation, then, that here goes into the making of a cosmos but enumeration, as of the days, which serves to control and differentiate recurrence.

The biblical conception of cosmogenesis has in later times invited illustration, and Renaissance and baroque artists in particular sought to embody not only its dichotomous symmetries but the dynamism of the act itself. An older pictorial ambition sought to subsume the act of creation in its product. It did so by incorporating creation in a cosmic image of contained perfection, a chart of the universe, stratified and annular, that also submerged the opposed dualities. The illustration that presides over the Creation in a fifteenth-century German Bible, for example ([fig. 3.1](#)), shows the divisions as a series of concentric rings in the globular universe, a virtual monopole penetrated by God’s creative Word. In this intricately patterned image, dualities and even bilateralism survive in the Edenic sphere of the earth itself, while in the more perfect regularities of the firmament (whose fanciful crenellations accommodate both air and fire and the heavenly bodies), sun and moon are almost lost among the stars. The four winds at the corners of the chart help fill the void and square the circle.<sup>4</sup> Pictorially they deemphasize the divine vertical axis and reinforce the homologous multiplicity of diameters. They even face away from the momentous event at the heart of the concentric spheres, the birth of Eve from Adam’s side, midwived by the embodied Word.

Artists swept up in the newer current of humanistic representation, however, sought to evoke and isolate the action of creation. In Genesis not only is creation represented in language; it is accomplished largely by fiat. But for a mimetic visual art, such speech acts



are not in themselves eloquent or striking. Consequently, some artists turned to representing what might be called the subtext, the physical action implicit in the word even where will and deed are understood to be indistinguishably one. Thus, the creative act is condensed into the dynamic bodily gesture of division and separation in Raphael's Vatican loggia design for God dividing the light from the darkness (1518–1519). In a print after the scene, the elemental chaos is rendered as an amorphous billowing dough scrawled with fire, and the bounding figure slanting through the picture plane with arms extended and thrusting overwhelms the protean resistance. With the action scarcely contained, the design achieves a dynamic symmetry, lozenge shape included, around the separation that is an opening into light (fig. 3.2).<sup>5</sup>



FIGURE 3.1. Der Geschopf, from Genesis (Germany, 1476?). The Holy Bible ("The Kitto Bible").

Source: By permission of the Huntington Library, San Marino, California.





FIGURE 3.2. Giulio Romano, after Raphael, *Divisit Lucem a Tenebris* (1517–1518), Vatican loggia, unidentified engraving. “The Kitto Bible.”

Source: By permission of the Huntington Library, San Marino, California.

Division and separation is the fundamental drama of creation in a remarkable series of 1589 from the workshop of Hendrick Goltzius. Day 1 ([fig. 3.3](#)) shows an angelic agent using crossed staves that suggest dividers to separate withdrawing Night from spreading Day, both personified. Day 2 ([fig. 3.4](#)) shows the same agent (with a garland headdress of the winds to help) dividing the earthly waters from the heavenly, the former appearing as a river god, the latter accompanied by rainbow and sprinkler. Black and white, male and female, reinforce the representation of the creative act as division and distinction in these images, and the tondo form suggests both cosmos and the undifferentiated, nondirectional homogeneity of a prior state.



FIGURE 3.3. Hendrick Goltzius, workshop, *Creation, Day 1* (1589). “The Kitto Bible.”

Source: By permission of the Huntington Library, San Marino, California.

The emblematic, comprehensive image that leads off Goltzius’s series shows two heroic male figures, one front, the other back, pulling in opposite directions on a star-tipped rope with the great globe of Creation suspended between them and the spirit of God floating above as upon the face of the waters. Such reflective doubling, intrinsic to the mystery of spiritual agency in a material creation, also appears, for example, in Hans Lachner’s creation series (ca. 1580), where the triune agent acts through the contrapuntal gesture and attitude of Father and Son. In the illustration for the Fourth Day ([fig. 3.5](#)), these two

virtually mirror each other, except in “handedness”: the pointer or wand (the dividers divided) that each bears in his right hand and the turn of their palms. The dynamism of creation is expressed along the powerful diagonal (reinforced by the divided light and dark and the broken arc of the zodiac), which plays against the interlocked and encircled complementarity of the divine center. The quadrature of the whole supports a four-cornered distribution of the elements, earth, air, fire, water.



FIGURE 3.4. Hendrick Goltzius, workshop, Creation, Day 2 (1589). “The Kitto Bible.”

Source: By permission of the Huntington Library, San Marino, California.



FIGURE 3.5. Hans Lachner, Creation, Day 4 (ca. 1580). “The Kitto Bible.”

Source: By permission of The Huntington Library, San Marino, California.

If differentiation, the creation of diversity and multiplicity where before there was a generalized unspecific sameness, is the route from chaos to cosmos in Genesis, it is also the route from cosmos to chaos. Despite such complications as the inclusion of a second creation narrative with a notably different tone and focus, the first eleven chapters of Genesis do have a unity of scope and interest: in origins and in the universal (“world-historical”) basis for what will continue—in the narratives that follow—as the history of a specific people. The final piece of world-historical framing in Genesis falls into place between an eponymous genealogy of the nations that repopulate the earth after the deluge and the generational trace that starts out with Shem and brings us to Abraham, the first of the Hebrew patriarchs. It presents the story of the Tower of Babel (Genesis 11:1–9), from the time “when the whole earth was of one language and of one speech” and when mankind was one people. But when the people propose to build a tower and a city, not just to “make us a name” but to prevent any enfeebling dispersal, God spoils their plans by deciding to “confound their language, that they may not understand one another’s speech.” With that they leave off building their city and are scattered abroad, over the face of all the earth.

The chaos of language—a parallel universe whose post-Adamic fall occurs here, when the word loses its pristine identity with the universe of things—is a vast subject that I hope to address elsewhere. Here I am only concerned with the mechanism at work and its relation to the original cosmic confusion. “Confuse” (*balal*) is the operative word for God’s linguistic intervention, reinforced in the text by an onomastic pun on Babel (Babylon). The association of the events at Babel with the primal confusion is strong enough to surface, for example, in Cesare Ripa’s immensely influential *Iconologia* (1593), where, as in the illustration Gottfried Eichler the Younger supplied for a notable later edition, Confusion, personified as an unkempt young woman in variegated robes, is placed between the astonishing, incomplete Tower of Babel and an Ovidian primal chaos on which she stands (fig. 3.6).<sup>6</sup>

However, despite the association between the confusion of tongues and the primal confusion, the mechanism of the return to chaos is not in fact reversal—a stirring together of elements that constituted a cosmos through division and separation—but, on the contrary, more division and separation. As a result of the confusion of tongues, the languages and peoples of the earth are multiplied and differentiated as the animals were when brought forth from the earth, but with opposite intent. One eighteenth-century print after Gerard Hoet, aptly captioned in Hebrew, English, German, Latin, French, and Dutch, and in as many typefaces, shows the quarrels erupting among the builders in their mutual incomprehension, with bricks and measuring rods turned into weapons (fig. 3.7). Another, somewhat earlier, designed by Karel van Mander, shows the peoples of the earth, now in all the variety of national costume and racial feature, already with diverse alphabets (Greek, Hebrew, pseudo-Egyptian), monumental styles, and religions, streaming away to the four quarters of the earth while a storm threatens the magnificent countercreation of their lost homogeneity (fig. 3.8). Multiplicity and diversity are evidently not all that it takes to



constitute a universe; in fact they can work to effect its disintegration. And number itself as the path between chaos and cosmos is a two-way street.



FIGURE 3.6. Gottfried Eichler the Younger, Confusio, engraved by I. Wachsmuth, illustrating Cesare Ripa's *Iconologia* (Augsburg, 1758–1760).

As a distinctly modern parable, Zbigniew Rybczynski's *Tango* also encourages a quantitative view of chaos but ties it to subjective experience. The film, some eight minutes long, begins with an unpopulated furnished room, a fixed interior with a missing fourth wall, like a crude stage set seen from a moderately high angle. Then a soccer ball bounces into the room through the open window in the rear wall. A boy appears, looks about, climbs in after the ball, snags it, and slides out the window head first. Then it happens again, and again. Meanwhile a woman carrying a crying infant enters one of the three doors, sits at the table, pops out a breast, nurses the infant, rises, lays it in a crib near the window, and goes out. Meanwhile a thief slips through the window, as oblivious of the others as they of him, flattens against the wall, steals a bundle from the top of the shelves, and slips out. Then a man in a hat and coat comes through another door and puts the bundle on the shelves where the thief will steal it. Other figures and actions accumulate: a grandmotherly figure sets soup on the table; a grandfatherly figure sits, eats, and removes the plate. A nude in

shoes enters, puts on a dress and panties, and leaves. A plumber carries in a toilet, sets it down, then picks it up and carries it through (fig. 3.9). An old woman in black lies down on the bed, crosses her arms on her breast and is seen to by a man with a black briefcase; then she gets up and goes. Every action is made repeatable, and once introduced, it is repeated, all to the sound of a tango beat, endlessly recurring. Before we are through, there has been an incremental accumulation of about thirty people, moving about and around one another, entering, acting, and leaving, like pieces of clockwork in their periodicity, except that their movements are syncopated like the music, and their numbers increase. There is an incremental accumulation also in the recurring sounds: the baby cries, shuts up, and cries; a man falls off the table while changing a light bulb and yells; a pair of lovers, grappling on the bed, make passionate noises.



FIGURE 3.7 Gerard Hoet, *The Lord Confounds the Languages of All the Earth*, engraved by A. van Buisen, illustrating Jacques [sic] Saurin's *Discours historiques...du vieux et du nouveau testament* (La Haye, 1728). "The Kitto Bible."

Source: By permission of the Huntington Library, San Marino, California.



FIGURE 3.8. Karel van Mander, Confusio Babulonica, engraved by Zacharias Dolendo (before 1604). “The Kitto Bible.”  
 Source: By permission of the Huntington Library, San Marino, California.



FIGURE 3.9. Zbigniew Rybczynski, Tango (1982), advertising card with stills.

It is the experience of the perceiver that is most instructive in all this. The perceiver is



like a juggler whose partner is throwing plates at him: first two plates in the air, then four, then six, all going round together. Every addition demands a more complex awareness and a more divided attention, until suddenly it all collapses. The system crashes in one's head despite the fact (in Tango) that one never doubts the systematic character of the phenomena. The multiplicity of the elements and the diversity of the recurrences are more than the mind can hold in a comprehensive pattern, and all at once it is experienced as chaos.

The experience itself is tied to the recognition of a human limitation. Some lines in Howard Nemerov's marvelous poem "Angel and Stone" capture it in another venue:

But if you drop a stone into a pool, and observe the ripples  
Moving in circles successively out to the edges of the pool and then  
Reflecting back and passing through the ones which continue to come  
Out of the center over the sunken stone, you observe it is pleasing.  
And if you drop two stones it will still be pleasing, because now  
The angular intersections of the two sets form a more complicated  
Pattern, a kind of reticulation regular and of simple origins.  
But if you throw a handful of sand into the water, it is confusion,  
Not because the same laws have ceased to obtain, but only because  
The limits of your vision in time and number forbid you to discriminate  
Such fine, quick, myriad events as the angels and archangels, thrones  
And dominations, principalities and powers, are delegated to witness  
And declare the glory of before the Lord of everything that is.<sup>7</sup>

Nearly as interesting in the Tango experience as the observer's role in generating chaos, as the quantitative, additive aspect, as the part played by sensory and intellectual overload, as the suddenness of the collapse and transformation, is the observer's compensatory response. Earlier in "Angel and Stone" Nemerov notes a certain arbitrariness in what constitutes each person's self-centered world, with "More distant galaxies shining like dust in any stray sunbeam / Of his attention." Having lost a comprehensive grasp of the whole, the observer in Tango is likely to fasten attention on a region, or on a few elements, arbitrarily chosen, whose recurrence continues to be perceived as a pattern. These provide both a stay against vertigo and evidence of the order and regularity of the whole, which is now actually a matter of faith. Making such an island of stability means engaging one's attention at the expense of the rest, so much so that when the thirty-odd figures, coming and going, very rapidly diminish to just a few, and then one (the old woman in black in her last resurrection picks up the ball and exits, leaving an empty stage), it always comes as a surprise.<sup>8</sup>

It is by no means irrelevant to the mental experience I describe that most of the figures in Tango are oblivious of the others, most of the actions independent of the others. The only significant patterning is recurrence, the only directionality, quantitative increase. There is no structure of subordination to organize the parts further, no pervasive interactive causality, no functions within an overarching purpose. One cannot in the immediate throes of apperception impose a narrative on the sequence of events. One can of course retrospectively impose a comprehensive interpretation as a proposition on what the film is "about": alienation and solipsism in modern society, the housing shortage in Poland, or, as the advertising declares, "A Metaphoric Picture of Human Fate." Interpretation is the effort

to make sense of the chaos, to reduce it, to subsume it, to make it go away. But such thematic propositions, even the more plausible ones (propositions that seek to substitute themselves, as “meaning,” for the primary or literal significations of what we see and hear), do not on repetition of the direct experience of the film’s succession of images alter the experience. That is, they do not prevent, in subsequent viewings, the onset of chaos, perceptual-cognitive collapse.

It is certainly to the point that, unlike the creator of *Tango*, the creator in the biblical universe finishes his work of division and multiplication by organizing the earthly part as a nested hierarchy under man’s dominion. On the other hand, though the confusion of tongues at Babel and the scattering of what had been one people over the face of the earth are surely multiplication and division, there is no structure or patterning that goes along with these developments, no concomitant assignment of place. Indeed, the whole point of the action, literally and figuratively, is to annul structure. Since differentiated multiplicity can thus undo a cosmos as well as govern its making, it is not surprising that for the great majority of subsequent interpreters of the biblical Creation, division and multiplication entail, besides quantity and difference, an assigned space in a fixed order. Thus Calvin describes the work of the second day as “to provide an empty space around the circumference of the earth, that heaven and earth may not be mixed together. For since the proverb ‘to mingle heaven and earth’ denotes extreme disorder, this distinction ought to be regarded as of great importance.”<sup>9</sup> Sir Thomas Elyot argues that it is “the discrepence of degrees, whereof procedeth ordre”; take but that away and all that is left is chaos. Shakespeare’s Ulysses agrees in a much cited homily on “this chaos, when degree is suffocate,” the distillation of a long tradition:<sup>10</sup>

Take but degree away, untune that string,  
And, hark, what discord follows! Each thing meets  
In mere oppugnancy. The bounded waters  
Should lift their bosoms higher than the shores  
And make a sop of all this solid globe.  
Strength should be lord of imbecility,  
And the rude son should strike his father dead.  
Force should be right; or rather, right and wrong,  
Between whose endless jar justice resides,  
Should lose their names, and so should justice too....

Implicit in an ordering of differentiated multiplicity by place is a geometric function of number, a spatialization that can incorporate structural and harmonic relationships. The stream of thought that carried such ideas into the Christian centuries in the West had Greek and Hellenistic sources, sources that surface, for example, in the view of number that the platonizing Philo Judaeus adopts in the first century A.D. when he expounds the Mosaic record of creation. He explains that Moses says the world was made in six days, “not because the Creator stood in need of a length of time (for it is natural that God should do everything at once, not merely by uttering a command, but by even thinking of it); but because the things created required arrangement; and number is akin to arrangement.”<sup>11</sup>

Philo, who also draws on neo-Pythagorean sources, then explains the appropriateness of the number six to the making of a cosmos, as the first “perfect” number. That is, six is

both the product and the sum of its factors (1, 2, 3), “being made equal to its parts and being made complete by them.” Moreover, it proceeds, like the creatures that inhabit the earth, from a conjunction of male and female, and it contains both those principles, “for in existing things the odd number is the male, and the even number the female” (and  $3 \times 2 = 6$ ). Four centuries later, St. Augustine makes much the same case as Philo for the six days of creation (he omits the numerical gendering) and concludes, with a citation from the Wisdom of Solomon (11:20), “It is not pointlessly said, in praise of God, ‘Thou hast ordered all things by measure and number and weight.’”<sup>12</sup>

## SOPHOCLES’ THOUGHT EXPERIMENT

The chaos of the many, of multitudinousness, comes more easily to the modern imagination than the chaos of indifferentiation, of the one. Chaos is a crowd scene, like Ensor’s Entry of Christ Into Brussels, or the urban mob on the rampage in Dickens’s Barnaby Rudge, or possessed by the fevers of war, as in Zola’s Nana—though, as in Ensor’s painting, where a tiny Christ is almost lost from sight in the vast disorderly parade, multitudinousness and indifferentiation after a point may seem to converge. They converge all the more readily because, in the chaos of the many, multitude is experienced as the numberless, whereas number, or quantitative means, has served universally as an instrument for dispelling chaos, or distancing it, or working magic against it. Counting things means fixing them “ordinally” through number. But in a deeper sense, counting things means reducing or ignoring their infinite differences. Mensuration depends not just on comparison but on the establishment of a unit of comparison. It reduces multivariance to multiples of sameness or to the mere fact of sameness or difference. Sameness and difference translate into equivalence and nonequivalence, giving an abstract turn to the underlying notion of identity. Through counting and measuring, identity—meaning simply discrete individuality, being oneself and not other—acquires another aspect as a unit with comparability, of potential interchangeability. Without identity there is no basis for enumeration, but made abstract and relational, identity comes in turn to depend on numerical value. When the possibility of a universe of experience resting on a permanent ground of chaos is imagined in ancient Greece, Sophocles frames the question as a challenge to the principle of identity, but identity that has to incorporate both the discrete individuality and the potential equivalency of the unit.

A latent disorder made manifest before a final purgation is a structural feature of the genre of tragedy. A passage through sustained disorder is equally characteristic of comedy and, indeed, of most narrative, where discord and resolution (deferred) create the continuum of interest. What then gives Sophocles’ Oedipus Tyrannus a special place in the imagination of chaos? And what has it done to deserve the tag, surely anachronistic, of “Sophocles’ Thought Experiment”?

The answer to both questions lies in the strategy of extremity that governs the play and the success of that strategy in transforming disorder into a possible absolute—that is, into chaos—projected as universal condition in a possible world. Among the great tragedies, King Lear manages a similar feat, of universalizing local and genre-based disorder and

projecting it as a representation of fundamental chaos.<sup>13</sup> But Oedipus additionally has the quality that Coleridge responds to in calling it one of the three most perfect plots ever planned and that Cocteau gestures at in naming his version *The Infernal Machine*. That is, far from “chaotic” itself, it has something of the abstraction, economy, and completeness of a Euclidean demonstration; one that starts, however—like Einstein’s proposal of a traveler moving in company with a light wave—with the hypothetical case that presses the limits.

## IMAGINING THE WORST

The limiting case has been a powerful heuristic device in the physical sciences, in philosophy, and in mathematics, including the geometrical modes favored by the Greeks, and the limiting case, rather than the median or the statistical norm, is characteristic of philosophic tragedy. If Sophocles’ Oedipus addresses the question “What is it to be Man?” or even “What is Man?” it does so by putting the further question: “What is the worst thing that can happen to a man (a human being) without his ceasing to be one?” By exposing a representative man of exceptional capacity to the utmost extremity of evil and misfortune—where he becomes the murderer of one parent and the incestuous husband and lover of the other—perhaps one may arrive at some deeper, truer knowledge of the nature of the species. The experimental situation is simplified by choosing as the subject no random specimen but rather the most fortunate and competent of men, whose special endowment—magnifying that of ordinary men—is to know. (In the opening of the play, the priest leading the suppliants defines Oedipus as not equal to a god but rather as the “first of men,” the noblest, and—as has been proven—the most skilled in finding out.)<sup>14</sup> In a different cultural milieu, God and the Devil subject Job to a similar experiment, but it is an even simpler one in that Job is not an active agent in his suffering, and coming to knowledge through its unwavering pursuit plays no comparable role in bringing his suffering home. Job may be a better theologian than his friends, but he is no scientist.

It is not simply the nature of Man that is at issue in Oedipus Tyrannus; putting the question in such isolation would give a modern cast to the injunction to know thyself. The real issue is the nature of man’s life in the world, and to come to a determination about that requires an inquiry into the nature of the world of which men are a part. If the world is a place indifferent to distinctions and divisions, where, for example, one may be both wife and mother to one man or father and brother to one’s children, and where agency and intent count for nothing, then it exists as a chaos of indifferentiation. If the world is a place where there is no connection between events or people, no blood ties or obligations, no predictability or *pronoia*, but only chance and the phenomena of the moment in multitudinous singularity, then it exists as a chaos of randomness. The first is that primal chaos, the amorphous One. The second is that entropic chaos, the numberless Many. Both deny structure and succession. The horror of the first is expressed in numerous permutations on the theme of mingling—as of generations in the same womb—by Oedipus, the chorus, Jocasta. The dizzying peril of the second is implicit in Jocasta’s blasphemous reassurance,

Why should man fear since chance is all in all  
for him, and he can clearly foreknow nothing?  
Best to live lightly [eike, at random], as one can, unthinkingly;

and it climaxes in Oedipus's hubristic and enthusiastic proclamation of himself as the child of Luck—"She's the mother from whom I spring"—on discovering his foundling condition.<sup>15</sup> The problem for much Greek philosophy, from Anaximander to Plato and beyond, was to find a path between the one and the many; that for the play is to locate the reality of experience between the chaos of indifferentiation, on the one hand, and that of anarithmia, or numberlessness and randomness, on the other. The matter put to the test by the thought experiment of the play is the question of the ultimate ground, or limiting principle or container. Which is fundamental, law or lawlessness, structure or the hypermetric negations of structure? And if it is law, then how to take account of the eruptions of the hypermetric extremes, of indifferentiation and anarithmia? Can such chaos be bounded and contained?

## TAKING THE MEASURE

As developed in the play, the problem of the foundations is framed in terms of mathematical logic, and—through the gripping involution of the plot that has Oedipus pursuing himself—Oedipus himself is the principal investigator. That Oedipus is a mathematician as well as a detective appears in his language. Bernard Knox has effectively shown how the language of mathematics pervades the play, particularly the root terms for equation and mensuration.<sup>16</sup> For Oedipus, number is the clue through the labyrinth. When he learns of the circumstances of the slaying of King Laius, so like a remembered encounter of his own, he looks to the numbers to tell him the identity of the slayer. If the witness holds to the same number of assailants as formerly, then Oedipus cannot be the killer, "For one is not equal (isos) to many." But if the witness speaks of one man, traveling alone, then the two events can be one. Commensuration is for Oedipus the key to relationship and even identity, as in the case of the ancient herdsman brought before him, who is "symmetros" in age with the messenger from Corinth. It was commensuration in time and place that first suggested to Oedipus that Laius and the stranger he killed might be—the words suggest how he shrinks from the thought—in some way "akin."<sup>17</sup>

The chaos of numberlessness, subject neither to limit nor mensuration, appears in the play as the great social crisis of the plague. Its manifestation is paradoxically negative, as death and a blight on fertility. Since numbers in fifth-century Greece were necessarily positive, and in conception limiting and limited, there is perhaps an extra measure of horrified dismay in an expression that unites the negative with the innumerable.<sup>18</sup> "In the unnumbered (anarithmos) deaths / of its people the city dies," says the chorus. And correspondingly, its sufferings are without number (anarithma). Even Thucydides, speaking of the deaths among the multitude during the second visitation of the plague in Athens, uses a less vertiginous term (bk. 3, sec. 87): a "number not to be found out" (anexeuretos arithmos). Seven centuries later, the philosopher Plotinus, seeking a comprehensive definition of evil in the shadowy world of sense experience that holds harmless his Platonic



metaphysics, would fall back on a threefold conception of evil “as a kind of unmeasuredness in relation to measure, an unboundedness in relation to limit, and formlessness in relation to formative principle.”<sup>19</sup>

The chaos of indifferentiation appears in the play not simply as incest but as riddles of identity, where things are and are not themselves. At issue in these riddles is the principle—the most fundamental to knowledge, and the most certain of all, says Aristotle—“that it is impossible for anything at the same time to be and not to be.” In more technical terms, “It is, that the same attribute cannot at the same time belong and not belong to the same subject and in the same respect” (Metaphysics 4, sec. 1005b). Or as Engels put it in his *Dialectics of Nature*, “The law of identity in the old metaphysical sense is the fundamental law of the old outlook:  $a = a$ . Each thing is equal to itself.”<sup>20</sup>

The last riddle that Oedipus has to resolve is that of his own identity: that a is indeed equal to a and that he is equal to himself. The first such riddle of identity was that put by the Sphinx, before the events of the play. Oedipus’s success here is the rock upon which the chorus founds its confidence in his heroic efficacy. Even in the very end, when all is known, when the chorus proclaims the name and identity of Oedipus, it is as “Oedipus, who knew the famous riddles,” with a play on the name and the verb for knowing and with “riddle” (ainigmat’) now in the plural. The riddle of the Sphinx, herself a biform anomaly, is not repeated in the play in so many words, though it is in effect recapitulated in the whole. Doubtless it was well enough known. It is a riddle of identity, put in arithmetic terms: how can three be equal to one? How can something be and not be equal to itself? “What is the creature which is two-footed, three-footed, and four-footed; and weakest when it has most feet?”<sup>21</sup> The answer—man (as defined by his feet), man (extended in time)—is proleptic of much that clues in the later Oedipal riddles. The temporal clue in some versions of the Sphinx’s riddle (i.e., the three times of the day) is a geometric compression, time rendered as virtual simultaneity and metaphor masking as triangulating literalism. The meeting of three in one will apply not just to the roads between Daulia, Thebes, and Delphi, where the murder took place, but to the meeting of generations in Oedipus: father, husband, and son, equated in the womb of his mother-wife with both Laius and his sibling-children.

The new riddles of identity are also framed in terms of mathematical logic. How can whoever killed Laius be both one and many? How might the “stranger” Oedipus killed be one with Laius? How can one message be both pleasing and sad? When the messenger from Corinth tells Oedipus that Polybus was his father “no more than I, but just so much (ison),” Oedipus asks, “How can my father be my father as much as one that’s nothing to me?” (1018–1019). It is Tiresias who puts the riddles of identity to Oedipus most forcefully and least tactfully: “I say you are the murderer of the king / whose murderer you seek” (362). The seer tells Oedipus that evils he knows nothing of shall equate him both to himself and to his own children (424–425), that if for Oedipus Tiresias is a fool, for Oedipus’s parents he is wise, that “this day will give you birth and destruction.” “Always riddles,” Oedipus complains; “It’s what you are best at,” Tiresias rejoins (438–440). Before he leaves the stage, Tiresias sums up the identity puzzle of the murderer: a foreigner who is a citizen and true native, a blindman who has sight, a beggar who is rich:

He shall be proved father and brother both  
to his own children in his house; to her  
that gave him birth, a son and husband both;  
a fellow sower in his father's bed  
with that same father he murdered.  
Go within, reckon that out...

(450–461)

All these contradictions and paradoxes, all these seeming violations of the law of identity, depend for their resolution on Oedipus being who he is, equal to himself. But behind that, it is the rationality of the universe, its foundation on law, and the possibility of true knowledge and of meaningful action that depend on his being who he is. No mere persistence of prideful self-importance drives Oedipus to tell the chorus it need not fear to touch him since his are evils that no one else but only he among men can bear (1415). His being who he is explains how three generations can come together in one, how the hunter can be the hunted, and above all how the oracles, on whose validity the existence of a universe of law equally depends, can be true.

## ONE WORLD OR MANY?

That the alternative to the validity of the oracles is chaos is made plain not only in Jocasta's and Oedipus's premature celebrations of randomness but in the earlier, momentous third choral ode, where the chorus distances itself from Oedipus and Jocasta and looks for reassurance elsewhere. The ode falls between Oedipus's exposition of the oracle that led him to abandon Corinth—predicting that he would lie with his mother and murder his father—and the coming of the messenger from Corinth with news of Polybus's death. By that point all three pertinent oracles have been set before Oedipus and the audience: the earliest, predicting the death of Laius by his son's hand, retold to Oedipus by Jocasta as proof that there is nothing in prophecy, and the latest, concerning the pollution harbored in Thebes stemming from the murder of Laius, brought back by Creon from Delphi. They exist in disjunction and, indeed, in apparent contradiction with events. It is then that the chorus, praying for piety, speaks of "the laws that live on high": "laws begotten in the clear air of heaven, / whose only father is Olympus" (865–868); laws (*nomoi*) that are pointedly timeless, universal, and independent of mortal origin. But the chorus is worried—that distinctions such as those between self-serving tyranny and ambition for the state, just actions and impious ones, might be lost, that the connection between acts and consequences might fail—and it declares that it will cease to go to worship at the holy places unless the oracles are proven to fit events. Or, as Bernard Knox sums up its conclusion, "'If these things do not coincide [*harmonsei*, 905]—if the oracles are not equated to reality—then 'the divine order is overthrown' (*errei ta theia*, 910)."<sup>22</sup>

That chaos is the issue depends initially on the given, a story with plague added to parricide and incest. That such things can happen raises the possibility that chaos is the ground on which all else rests. That they do happen, and with unthinkable deliquescent effect, was recent common experience outside the play, in the case of the plague. In the

world of the play, it is the existence of the oracles that argues that law rather than lawlessness is fundamental, that chaos is contained. Whether there is coherence between the oracles and events is how the issue appears in the immediacy of experience. It is how the characters and the chorus put the question in the play. The nature of such coherence—how law and the knowledge based on law can enter the field of events and actions—is how the issue appears to informed reflection.

Finding the congruence between the oracles and events is a problem like that of all the other riddles. Incompatibilities are to be reconciled within a framework of fundamental law whose logic—notably the principle of identity and its reciprocal, the law of contradiction—they seem to violate. In the thought experiment that seeks to understand the nature of man in terms of his life in the world, there can be no ultimate disjunction between the world of laws (or the gods) and the world of experience. What is true in the one must hold in the other. The oracles are facts as well as factual statements, data to be reconciled with other data, including events. It is the job of the plot, with Oedipus as its propelling force, to find an equation that includes all the data, to make it all work out. As with the riddle of the Sphinx, Oedipus's problem is not too little information but too much. It makes finding the inclusive equation all the harder. If there were no such equation to be found, leaving a fundamental incoherence between the oracles and experience, the result would be the demonstration of chaos.

The coherence between the oracles and events is revealed in the action of the play. The premise of coherence is also inherent in the given, in what the audience presumably knows of the Oedipus story beforehand, but the nature of the coherence is no such foregone conclusion. It is the obligatory interpretive issue, and it emerges in any modern discussion that permits thematic, generic, and philosophic concerns to enter. In the classroom, the issue is often reduced to the antinomy of freedom and fate or to the problem of ignorant guilt, and it can be complicated by Oedipus's convincing self-exculpation in Sophocles' Oedipus at Colonus. But in equating the worst of crimes with the worst of evils that can befall their perpetrator, it is the play itself, Oedipus Tyrannus, that insistently asks how to understand the relation between the oracles and the actors, how to reconcile both freedom and responsibility with a universe of laws and a structured reality. The answer must come through the very mechanism that provokes and intensifies the question, the infernal machine of the plot in which every conscious step taken to evade the fulfillment of the oracle is a step in bringing it about. Accordingly, the resolving formula of a dualistic, noncontaminating congruence between Oedipus's actions and the oracles is not in my view as convincing, nor indeed as near to the actual truth of things, as the answer that lies in the play. Bernard Knox finds a suggestion for such a noncontaminating congruence in the mathematics that governs even that passage where the stunned chorus adds up the total of men's lives and finds it equal to nothing (1186–1187). Knox writes, "Oedipus' will was free, his actions his own, but the pattern of his action and suffering is the same as that of the Delphic prophecy. The relation between the prophecy and the hero's action is not that of cause and effect. It is the relation between two independent entities which are equated."<sup>23</sup> Rather, I believe that Oedipus discovers and the play demonstrates, at his expense, that a meaningful nonrandom universe in which men play a differentiated part—a universe between two chaoses—is

necessarily a self-referential universe. That is, predictability (prophecy) is contained in the system rather than standing outside and apart, the insulated product of a detached observer. Prediction both alters and enables the outcome and is necessary to its own validation. And the same interactivity marks knowledge, or taking the measure of things. Indeed, such knowledge, focused on what is and what was, forms a continuous field with prophecy. Oedipus, looking to pinpoint the facts surrounding the murder of Laius and the facts surrounding his birth, is part of what Werner Heisenberg called “an observational situation,” which the physicist offers in place of “objective processes in space and time” as the quantum of scientific description.<sup>24</sup> The character and effect of Oedipus’s looking cannot be left out of the equation—and his eyes will pay the price.

## “NUMBER-WORLDS”

One interpretation of the self-referential world proposed by modern physics has it that “the process of measurement in some way determines the values, brings into actuality what was before a potentiality.”<sup>25</sup> Despite the language of before and after, such a conception implies another temporal structure than that we are most at home with, enshrined in Newtonian mechanics. It is the latter that creates the most difficulty for a reconciliation of causality with free agency and responsibility. But a rather different temporal conception is at work in Sophocles’ play, one that better agrees with post-Newtonian notions.

Polybus’s death, says the messenger from Corinth, was appropriate to his length of days—or, rather, “commensurate with long time” (*makroi...symmetroumenos chronoi*, 963). “All-seeing time,” the chorus later tells Oedipus, has without your wanting it found you out (l. 1213). Time has dimension, but it is more than simple duration or linear succession hosting a chain of causes and effects. It belongs to the geometry of reality rather than to its serial history. Oedipus’s quest through “all-seeing time” inadvertently leads him to himself and as such reveals not the past but a present that includes the past. As with the riddle of the Sphinx, the solution is integral because it is able to incorporate the dimension of time. Within the structure of reality that time reveals, oracle and event, act and inquiry are integral because time is integral, geometric rather than serial. And number itself, inasmuch as it inheres in reality, is also more geometric than serial.

What one might call the number feeling of fifth-century Attica is not likely to be truly recoverable, even by the best-equipped archaeologist of mind. But the hints are numerous, starting with what is known of the number notation in use. That was “acrophonic” and additive; that is, except for the unit sign (the universal stroke), its symbols were the initials of the Greek words naming the numbers, or combinations of them.<sup>26</sup> The limitations of such a system did not guarantee that geometry would be the great path of development for Greek mathematics, as it was, but certainly Greek notation did not encourage algebraic abstraction nor even a powerful arithmetic. Moreover, the intimate association between number and language, number and name, that such a system displays is no less a clue to mentality than the Greeks’ treatment of fractions as whole-number relations, their association of number with measure and limit, and the absence of a zero symbol. There is a



direct connection between the turn in Greek thought that proposed number as the route to understanding the structure of the universe and the fact that the alphabet provides a recurring analogy for the composition of the cosmos in Greek philosophy and its descendants. The term for element—*stoicheion*—is also that for the sounds represented by letters, and Leucippus (ca. 430 B.C.), justifying the variety and structure of a world generated from atoms, went so far as to call to witness the fact “that a tragedy and a comedy are composed of the same letters of the alphabet.”<sup>27</sup> On the other hand, when Socrates in Plato’s *Philebus* wishes to address the coexistence of unity and plurality in the universe of ideas and things (and explain how analysis can operate in the middle ground between the one and the many), he also invokes “the case of the alphabet,” where spoken sound is discriminated into classes (vowels, mutes, etc.), which are further divided into their members and then reunified under the notion of “letter.”<sup>28</sup>

*Oedipus Tyrannus* is a play that evokes specters of chaos in conflict with mathematical reasoning and numeration itself, a play whose hero’s tragic greatness lies not simply in finding the equations that resolve contradiction but in uniquely embodying them, and finally a play informed with the number ideas and number feeling of its culture. The latter are not simply a matter of the conventional notation. Some of these ideas and feelings are buried in the common language (roots for measurement, equality, numbers, lengths), often no doubt with the equivocal weight of dead metaphor, and some emerge forcefully in the particular idiolect of the play. In one of his more arresting excursions, a chapter called “The Meaning of Numbers,” where he contrasts the mathematical sensibilities of the classical and modern worlds, Spengler argues that mathematics is culture specific, that there are as many “number-worlds” as there are cultures, and that “the style of any mathematic which comes into being...depends wholly on the Culture in which it is rooted, the sort of mankind it is that ponders it.”<sup>29</sup> There would be nothing startling about the argument if it concerned religion or drama, but it is a bold mind that extends it to mathematics even in our century.

Spengler also generalizes across cultures when he writes that “Number is the symbol of causal necessity. Like the conception of God, it contains the ultimate meaning of the world-as-nature. The existence of numbers may therefore be called a mystery, and the religious thought of every Culture has felt their impress” (1:56). In identifying mathematical conceptions of reality with the world-as-nature (as opposed to the world-as-history) and with a spatializing and demarcating approach to structuring experience, Spengler’s generalizations seem especially appropriate to the Greek context. In italics he declares that “Nature is the numerable” (1:57) and credits Pythagoras with being the first in classical culture to give scientific form to that knowledge.

Spengler also comments, as have many others, on the Greek discomfort with irrational numbers and its reputed Pythagorean treatment as a dangerous secret.<sup>30</sup> It leads him to speak of feelings—feelings attached to ideas—which, if not as culture specific as he suggests, certainly take culture-specific forms; must have had particular force in a time of plague, civil turmoil, and a demoralizing war; and are recognizably those addressed in the thought experiment of *Oedipus Tyrannus*. Spengler identifies a

deep metaphysical fear that the sense-comprehensible and present in which the Classical existence had entrenched itself would collapse and precipitate its cosmos...into unknown primitive abysses. And to understand this fear is to



To measure was the guarded affirmation of a faith in the underlying structure and ultimate logic of things. Applied to Oedipus, Spengler's insight provides a welcome alternative to the view of the play as a counterstatement to the Protagorean epigram on man as the measure of all things. To measure by oneself is to find one's relation to the whole, to affirm the comprehensibility of the whole, and to connect knowledge with action.

The most powerful strain of mathematical thought in the time of Sophocles that we know about is the same that Spengler credits with giving scientific form to the concept that "nature is the numerable." But in Pythagorean thought, number did more than supply a measure for reality; it was constitutive of reality. Originating in the previous century, Pythagorean thought initially developed in a school with an oral tradition, and it may have entangled itself in religious secrecy, making its chronological development uncertain, but its claims for the ontological reality of number and for a physical identity between number and the cosmos were central doctrines from the start. That is, number was conceived as material and not as simply enumerative, as the stuff and measure of plurality in a structured universe. As Aristotle would note in the *Metaphysics*, where his critique of Pythagorean doctrines is for better or worse our most reliable guide to what they were,

And the Pythagoreans, also, believe in one kind of number—the mathematical; only [unlike the Platonists] they say it is not separate but sensible substances are formed out of it. For they construct the whole universe out of numbers—only not numbers consisting of abstract units; they suppose the units to have spatial magnitude. But how the first 1 was constructed so as to have magnitude, they seem unable to say.<sup>31</sup>

The constitutive role of number, as we learn here, is both material and structural, and the structural and the material are as one. Apart from the problem of the first 1 (which the Pythagoreans treated as a special case, not number but the beginning or principle of number), structure is implicit in the physical conception of number in that it inheres in proportion and relation given geometric expression. The relations of numbers extended in space are realized most strikingly in the heavens, perhaps including the Pythagorean harmony of the spheres, which later generations have found so appealing. Structure, moreover, in the Pythagorean cosmos, is understood to emerge from the action of limit on the unlimited, which otherwise seems to bear the character of the formless and undifferentiated void. That is, "the first 1," the primal singularity—whose acquisition of spatial magnitude troubles modern astrophysics less than it does Aristotle—draws in the unlimited in the process of numerical unfolding, and it is the incorporate unlimited that serves to accommodate the expansion.<sup>32</sup>

In Pythagorean doctrine as it descends in filtered and fragmentary accounts, there is no contradiction between number supplying the material principle and number supplying structure and limitation to what is otherwise formless and unlimited.<sup>33</sup> The conception of material reality as the geometric structuring of the void would be developed in Plato's *Timaeus*, and it would have unexpected twentieth-century avatars, but the Pythagorean account of the articulation of material and cosmic reality as the unfolding of a geometry led

the way.<sup>34</sup> The process of that articulation survives in elaborated form in the dutiful summary of Diogenes Laertius (writing belatedly but here drawing upon a creditable earlier source):

The principle of all things is the monad or the unit; arising from this monad the undefined dyad or two serves as material substratum to the monad, which is cause; from the monad and the undefined dyad spring numbers; from numbers, points; from points, lines; from lines, plane figures; from plane figures, solid figures; from solid figures, sensible bodies, the elements of which are four, fire, water, earth and air; these elements interchange and turn into one another completely, and combine to produce a universe animate, intelligent, spherical, with the earth at its centre.<sup>35</sup>

Put more succinctly, “The generation of the number-series is to the Pythagoreans...both the generation of the objects of geometry and also cosmogony. Since things equal numbers, the first unit, in generating the number series, is also generating the physical universe.”<sup>36</sup> And the moral universe as well.

## A GLANCE INTO THE ABYSS

The collapse of the present and sense-comprehensible order into the undifferentiated and the immeasurable, which Spengler projects as a deep metaphysical fear in Greek culture, recalls the account that Nietzsche gives of the Dionysian impulse in *The Birth of Tragedy*. Nietzsche’s Dionysian in essence is the experience of undifferentiated being; his Apollonian—marked by a “measured limitation”—is the expression of “the principium individuationis.” In Shining Apollo, prophecy and the shaping and remedial power of art come together in the intelligible beauty of the apparent. The Dionysian includes the monstrous horror (*ungeheure Grausen*) that “seizes upon man when of a sudden he is at a loss to account for the cognitive forms of a phenomenon, in that the principle of reason, in some one of its manifestations, seems to admit of an exception.”<sup>37</sup> But the Dionysian also includes a fearsome rapture in the collapse of individuation, in liberation from its constraints and release into primal unity. In Jung’s version, “Dionysus is the abyss of impassioned dissolution, where all human distinctions are merged in the animal divinity of the primordial psyche—a blissful and terrible experience.”<sup>38</sup>

Nietzsche’s account locates the greatness of Greek tragedy in its synergetic union of the two principles. His account of Oedipus Tyrannus, however, presents it as an Apollonian gloss on the dark terror of the myth. The sheer dramatic delight in the dialectical unraveling of what seems so indissolubly entangled and the protagonist’s nobility that itself becomes a restorative agency through catastrophe make the play into something Nietzsche compares to “the light-picture which healing nature holds up to us after a glance into the abyss.” In the unexhausted substance of the myth, however, Nietzsche finds the reverse of such reassurance. The myth of “the riddle-solving and mother-marrying Oedipus” tells us that “when the boundary of the present and future, the rigid law of individuation and, in general, the intrinsic spell of nature, are broken by prophetic and magical powers, an extraordinary counter-naturalness—as, in this case, incest—must have preceded as a cause,” that only the unnatural can provide the means for unlocking the secrets of nature, and “that whoever, through his knowledge, plunges nature into an abyss of annihilation, must also experience

the dissolution of nature in himself.”<sup>39</sup> This transgressive penetration to a deep-seated fundamental chaos, however, is only half the story. Its devastating extremity furnishes the premise of the Sophoclean experiment, which then works in reverse, sorting through the confusion and evidence of experience—imagined as the face of an underlying chaos—to an ultimate structure of limit and law.

Dissolution in the boundless and undifferentiated One and annihilation of difference in numberlessness—the arithmetic extremes that can be called chaos—converge in the experience of the plague. In the laments of the chorus, the numberlessness of the deaths and sorrows unites with their universal inclusiveness, falling alike on old and young, on barren women, grey-haired mothers, children left dead on the ground and spreading pestilence. In the multiplicity that becomes numberlessness and the inclusiveness that collapses all distinction there is a collapse of relationship as well as of difference, of the structure of difference. Released from connection and configuration, humanity becomes an undifferentiated mass of individuals.

René Girard comments that all descriptions of the plague are the same, whether they come from the great writers or from reporters with no literary pretensions. “The strongest impression is invariably that of a radical loss of the social dimension itself, the end of the rules and ‘differences’ which define cultural categories...it is the undifferentiating of culture itself, and all the confusions that follow therefrom.”<sup>40</sup> Girard locates the heart of how such a chaos is experienced in what happens to the system of exchanges on which society depends but whose reciprocities it normally dissimulates, often through deferral. In the collapse, he suggests, reciprocities both positive and negative (insults, injuries) are naked and immediate, conduct tends to become uniform and no longer governed by social relations, and that in turn creates the feeling of universal indifferenciation and confusion.

Thucydides’ description of the plague of 430 B.C. is the great and inescapable progenitor of many of the accounts to which Girard alludes, though probably not that of Sophocles. The date of that visitation is used to date the play, along with the chorus’s striking and unusual identification of the plague with Ares, the god of war and violence (Oedipus Tyrannus 190–215).<sup>41</sup> But there is good reason to accept Thucydides’ account as bringing us close to the veritable experience—the glance into the abyss—that helped frame the questions Sophocles’ play sets out to address.

After detailing the remote origins, local appearance, and clinical expression of the disease, the last from self-observation, Thucydides tells how the disease affected the assumed order of the world and the actual character of society. The collapse of the rational order is indeed represented, in Girardian terms, as the collapse of difference. Thucydides offers a catalogue: some died of neglect, some in spite of every possible care. The treatments that did good in some cases did harm in others. The naturally strong “were no better able than the weak to resist the disease, which carried away all alike.”<sup>42</sup> The sick died for no one to look after them, and those who visited the sick lost their own lives. The dying were stacked like the dead or staggered about the streets like the living. And the temples were full of corpses. The collapse of difference is also a collapse of the law of contradiction, on which rests predictability and the logic of cause and effect. In such a world, one doesn’t know what to expect, and so men “became indifferent to every rule of

religion or of law.” The rich suddenly die; the poor suddenly become rich. And with acts severed from their consequences and death hanging over all, prudence and honor cease to have a point. Secret vices become open indulgences, and “No fear of god or law of man had a restraining influence. As for the gods, it seemed to be the same thing whether one worshipped them or not, when one saw the good and bad dying indiscriminately” (2.52–53).

Here and elsewhere, Thucydides himself finds he has reason to scoff at the oracles, particularly the habit of retrospective interpretation to suit the fact. He offers no reason for the pestilential visitation. Set in the violent and unstable climate of the war, his account is framed not as an imaginative inquiry through displaced metaphoric action, as is Sophocles’ play, but as a precise, even technical delineation through accumulated detail. Consequently Thucydides’ anatomy of the plague in Athens is remarkable in its own right as a representation of chaos, positivist or rather phenomenalist in its physical and social reporting but profoundly imaginative in its evocation of the experience. It is when disorder is experienced as if there were nothing outside or beyond it, as absolute and all-consuming, that it becomes chaos.

## TRUTH AND POETRY

A thought experiment is a fiction, but it stands in a direct relation to the reality it investigates. It may proceed by counterfactuals and hypotheticals, but it does not proceed by metaphor, though it may need metaphor to explain its results. Oedipus Tyrannus is a more difficult case. It is a thought experiment, but it is also poetry, that is, metaphor. It offers the story of Oedipus and his quest not simply as a test-case probe of the way things are and might be but also as a comprehensive paradigm for the reality it seeks to illuminate. It is not just a model, however, because it is not an abstract. It is other yet the same.

Aristotle at his most seemingly pedestrian defines metaphor as saying “this is that,” whereby it seizes the interest of the hearer.<sup>43</sup> Saying “this is that” poses a riddle, a challenge to the principle of identity and the law of contradiction. It says something can be equal to itself and not equal to itself at the same time. Elsewhere Aristotle suggests that diction becomes poetic through its deviations from ordinary speech. “But a whole statement in such terms will be either a riddle or a barbarism, a riddle, if made up of metaphors, a barbarism, if made up of strange words.”<sup>44</sup> Oedipus, who is both a riddle to be decoded and a stranger whose otherness turns out to lie in his native connections, embodies both aspects of poetic difference. As we have seen, he is above all a riddle, especially to himself: an identity puzzle that says “this is that” and on whose solution depends the logic of everything. Solving the riddle of Oedipus—whose solution is darkly implicit in the puzzle—offers knowledge of what it is to be a man among men, acting and knowing in the real world. “The very nature indeed of a riddle is this,” Aristotle continues, “to describe a fact in an impossible combination of words (which cannot be done with the real names for things, but can be with their metaphorical substitutes).”

The association between number and language, number and name, inherent in the prevailing system of numerical notation achieves metaphoric status in the riddles Oedipus

has to unravel, including that of his own name (“Swellfoot” in Shelley’s blunt rendering but also oida, “I know,” and pous as a unit of measure). The association in Greek of nomos, law and custom, with onoma, name, is for the most part a creation of the ear, but there is an association deeper in the language between nomos and mensuration, division, and the setting of limits and distinctions, in that nomos appears to stem from a word having to do with the partition and apportionment of pastureland. (It also shares an ancestor with the Latin word for number, and our own.) One modern psychologist finds significance in this verbal cluster, even where it is most loose, and writes:

the noun [nom] has much in common with the law, considered as separation, division. It is a part of speech which names person, place or thing, that is to say, which takes it out of chaos and confusion and gives it definition. In fact, Genesis relates the Story of Creation not merely as a time of separating and dividing, but—and, in my opinion, this comes to the same thing—one of naming.<sup>45</sup>

## SIGHTLINES

Much more than indirect naming constitutes the poetry of drama, but while such elements as Oedipus’s action (his inquest) are manifestly integral to the poetry of the whole and to the thought experiment, not everything is equally overdetermined. Among those parts of the drama that seem superfluous to the thought experiment but vital to the metaphoric wholeness is Oedipus’s self-blinding. Some classical tellings of the story do not have Oedipus strike the blow himself, but Sophocles in *Antigone* and Aeschylus in *Seven Against Thebes* had already made a point of the fact that it was done with Oedipus’s own hand—the same hand, in Aeschylus’s emphasis, with which Oedipus had slain his father. In *Oedipus Tyrannus*, Sophocles adds that it is done with Jocasta’s brooch, but with or without that resonant detail, it is hard not to feel the dreadful appropriateness of the self-blinding act. Nevertheless, numerous critics, starting with Oedipus himself, have set out to explain it. Oedipus emphasizes the future, the impossibility of looking upon his children, city, people, father, and mother in the other world, now that his eyes are open. More recent critics have emphasized the past, the effect of having looked upon forbidden things, including the secrets of nature and of the self.

The feminization of nature and her secret places is no new thing, of course. Plato for example speaks of the primal “Mother and Receptacle of this generated world...a kind invisible and unshaped, all-receptive, and in some most perplexing and most baffling way partaking of the intelligible.”<sup>46</sup> Such imagery can be seen to represent the deep associations that link Oedipus’s incestuous sin and his relentless inquiry, his probe into origins and his looking upon a nakedness that it is somehow unfitting to know. But Plato himself subscribes to no such metaphoric transfer, to no poetry that would limit the passion for true intelligibility. As to vision as such and the role it has played in making sense of the world, he has this to say:

Vision, in my view, is the cause of the greatest benefit to us, inasmuch as none of the accounts now given concerning the Universe would ever have been given if men had not seen the stars or the sun or the heaven. But as it is, the vision of day and night and of months and circling years has created the art of number and has given us not only the notion of



Time but also the means of research into the nature of the Universe. From these we have procured Philosophy in all its range, than which no greater boon has ever come or will come, by divine bestowal, unto the race of mortals.

(Timaeus, sec. 47)

Sophocles is far from unaware that there is a courage, even a rashness, in confronting certain questions. He is not oblivious to the feeling that there are disturbing mysteries that it may be better for profane eyes, weaker eyes, not to see, and even Theseus is reported to shield his eyes from the unendurable sight of the realities unveiled at the end of Oedipus at Colonus. But Sophocles also understands that one can punish one's eyes for not seeing better. For it was as philosopher and mathematician, as systematic inquirer after truth searching into the nature of the universe, that Oedipus used his eyes. As he comes to see, he lives in a closed universe after all, and when he has proven its fundamental theorem, his task has come to an end. Oedipus Tyrannus was a single play, not a trilogy, and his act of self-blinding is conclusive.

The modern historian of science and culture Michel Serres extends Plato's insight into the agency of vision in the development of Greek science and mathematics in an essay that also sheds light on Oedipus's encounter with chaos. In "Mathematics and Philosophy: What Thales Saw," Serres begins with the story of how Thales measured the height of the pyramids by measuring their shadows, taking the observation "at the hour when the length of our shadow equals our height."<sup>47</sup> In a first-pass interpretation, he cites Comte on how the impossibility of direct measurement for many heights and distances leads to indirections and to the invention of mathematics. Geometry, as Serres puts it, is a "ruse of reason," a ruse that comes into play where touch fails, where the unit measure cannot be placed upon the object. "Some say that one must use a ruse of reason to go from practice to theory, to imagine a substitute for those lengths my body cannot reach.... In this sense, mathematics would be the path these ruses take." But such a formulation, Serres adds, leaves out the persistence of the practical. "For in the final analysis the path in question consists in forsaking the sense of touch for that of sight, measurement by 'placing' for measurement by sighting. Here, to theorize is to see, a fact which the Greek language makes clear. Vision is tactile without contact" (86).

Substituting sight for touch, practical theorizing for "placing" the body where it cannot—or ought not—be, and so finding the measure of things by indirection, is the thought experiment or "ruse of reason" carried out through the protagonist of Oedipus Tyrannus. In Thales' ruse as in Sophocles' play, theory frames the problem and imagines a path to its resolution. Both contrive to bring the human into relation with structures that otherwise threaten to escape human scale. Both incorporate the inquirer and the process of inquiry in the solution, and both translate the overarching problem into an exemplary and concrete case wherein man remains the measure. Time also comes into Thales' idea, as Serres shows. The pyramid is the gnomon of a sundial, with which "whoever measured space also measured time." By inverting the terms, Thales stops time in order to measure space "and so invents geometry." Time, however, becomes a conscious concern in the solution to the spatial problem (as in Oedipus), and synchrony is less the elimination of time than its spatialization, its incorporation in the relational structure erected on identity and difference and marked by the symmetry, definition, and arrangement that Aristotle attributed to both

beauty and mathematics (see note 18). Nearly two and a half millennia after Aristotle, Victor Hugo, writing as it happens about William Shakespeare, declared to the world, “The profound word Number is at the base of man’s thought; it is our intellect’s native element. It imports harmony as much as mathematics. Number reveals itself in art through rhythm, which is the heartbeat of the infinite.... Without number, no science; without number, no poetry.”<sup>48</sup>

Serres’s allusion to a serendipity in Greek diction refers to the derivation of *theoria*, theory, from *theasthai*, to watch or look at, and *theoros*, a spectator. Even more to the point is their *allele*, *theatron*, a theater, where spectacle and idea could keep company. As Serres writes concerning Thales’ theorem and the story of the pyramid, “In a culture with an oral tradition, story takes the place of schema, and theater equals intuition. The diagram of a theorem can only be transmitted in written form, but in an oral culture, drama is the vehicular form of knowledge” (88). Even in an electronic culture, however, the schema seem unable to forego story when it comes to structuring the amorphousness and multiplicity of phenomena in the theater of the mind. Gerald Holton points out how in elementary-particle physics, where the neat triad of proton, neutron, and electron has given way to a teeming subatomic zoo, one of the recurring tropes “is precisely this splendid one of groups, families, and superfamilies.” Earlier the family trope saw service in the periodic table of the elements and the Linnaean taxonomy of plant forms.<sup>49</sup> Despite the charm and mnemonic utility of these “village tales told by physicists,” one cannot help but feel the greater seriousness and sophistication with which Sophocles uses the family trope to imagine and define—that is, limit—chaos, in a thought experiment fused with metaphor, from whose *theoria* emerges the conception of a structure of law underlying the randomness of experience, a structure of reality that joins the knower and the known.

## EVERYTHING BY ONE AND ONE

From the standpoint of psychology (“the science of finite individual minds”), William James offers an inside view of the uses of number as a means of coping with sensible experience. Writing a decade or so before the detonation of the Planck-Einstein revolution but at a time when the relation of physical science to the real world had already emerged as an issue, James observes:

The relation of numbers to experience is just like that of “kinds” in logic. So long as an experience will keep its kind we can handle it by logic. So long as it will keep its number we can deal with it by arithmetic. Sensibly, however, things are constantly changing their numbers, just as they are changing their kinds.... Unless our arithmetic is to remain without application to life, we must somehow make more numerical continuity than we spontaneously find.<sup>50</sup>

Success in applied arithmetic means that cosmos becomes the numerable, that order is identified with number, number with order, and, in a legacy from Greek mathematics and philosophy, the two together give access to the ground state of what constitutes reality. As a consequence, when number fails, chaos is come again.

In traditional science, that troublesome condition may be imagined as temporary. In a

treatise on thermodynamics, James's contemporary Peter Guthrie Tait, a leading Scottish physicist, declares apologetically, "Until all physical science is reduced to the deduction of the innumerable mathematical consequences of a few known and simple laws, it will be impossible completely to avoid some confusion and repetition, whatever be the arrangement of its various parts which we adopt in bringing them before a beginner."<sup>51</sup> Tait's faith as a scientist lies in that "until." It lies also in the program of reduction, generalization, and application pursued through a language—mathematics—whose syntax and vocabulary are congruent with physical reality. It is a Cartesian program harnessed to the scientific optimism of Laplace. It posits the goal and asserts the possibility of a universal description in mathematical notation of a coherent, continuous, and predictable cosmos. Confusion and systematic discontinuities appear in Tait's apology as a historical accident, a temporary condition and not a necessary limit, and certainly not something corresponding to an intractable incoherence in objective reality.

More recently, however, even the physics that continues to deal with the observable world along classical lines has had its confidence qualified by the perception of limit and the need to acknowledge real-world complexities wherein (in the language of the leading British journal of science) "the initial conditions would be intrinsically unknowable, and the time-course of the development of the macroscopic system therefore intrinsically indeterminate." The writer continues with a definition: "In this strictly classical sense, chaos is a way of referring to circumstances in which applied mathematics is imperfect—either the differential equations cannot be solved with sufficient accuracy or they (or the boundary conditions that should apply) cannot be accurately defined."<sup>52</sup> The troubling perception that makes "chaos" here more than a convenient label is that the mathematics can never be perfect enough (or the boundary conditions so compellingly clear as in Sophocles' thought experiment). If that is so, then Tait's program of reduction, generalization, and deductive application can never be complete, either in the sense of eliminating "confusion" in the system of knowledge or of theoretically accommodating all physical phenomena. Can Laplace's premise—that if we knew enough about position and momentum in the present universe we could predict all its future configurations—have anything more than a quaint historical interest when one can demonstrate the impossibility of knowing enough? Furthermore, where the mathematics fails in application or consistency, it once more raises the Sophoclean question of the ground state underlying all.

How to label the ground state doesn't interest William James as much as does redefining our relation to it. To explain "The Genesis of the Natural Sciences," he invokes our experience of the world, something very different from the world as it presumably exists. "The reality exists as a plenum. All its parts are contemporaneous, each is as real as any other and each essential for making the whole just what it is and nothing else. But we can neither experience nor think this plenum. What we experience, what comes before us, is a chaos of fragmentary impressions interrupting each other; what we think is an abstract system of data and laws."<sup>53</sup> The reality, in other words, is inaccessible, and labels like "chaos" and "order" have no real meaning when applied to what is. But experience and thought are accessible, and labels like chaos and order can be put to good use to express their differences. Chaos we are given; order we make. And though one evokes the other in

James's account, there is no reason to presume a congruence between "what comes before us" and "what we think," between experience and science—quite the contrary. Between the chaos of fragmentary impressions and the abstract system of data and laws there would seem to be no necessary connection but rather a fundamental difference in kind, bridged by need.

In a lengthy note to the passage I have quoted, James quarries an earlier piece, originally an address, in which he credits the transformation of "the world of our impressions into...the world of our conceptions" to something he calls "our volitional nature," from which there is no escape. Though he adduces a chaos of impressions, he does not here pause to consider whether the senses are capable of registering a chaos on their own or of receiving impressions without reference to anything. But he does make much of how difficult it is to undo the order we construct, by stressing the effort that has gone into its making and its remoteness from what we were originally given. Only after "picking out from it the terms that concern us, and connecting them with others far away, which we say 'belong' with them, [are we] able to make out definite threads of sequence and tendency, to foresee particular liabilities and get ready for them, to enjoy simplicity and harmony in the place of what was chaos."

But despite the difficulty of deconstructing a world that serves "our emotional and practical subjectivity," James offers his audience an evocation of the chaos of unstructured multitude that it displaces, a representation of chaos that is a notable tour de force in its own right. That such a chaos is mentally and emotionally intolerable and thus—except through indirection and a form of illustrated generality—unimaginable is not to James scientifically irrelevant; it is the central fact. James asks:

Is not the sum of your actual experience taken at this moment and added together an utter chaos? The strains of my voice, the lights and shades inside the room and out, the murmur of the wind, the ticking of the clock, the various organic feelings you may happen individually to possess, do these make a whole at all? Is it not the only condition of your mental sanity in the midst of them that most of them should become nonexistent for you, and that a few others—the sounds, I hope, which I am uttering—should evoke from places in your memory, that have nothing to do with this scene, associates fitted to combine with them in what we call a rational train of thought?—rational because it leads to a conclusion we have some organ to appreciate. We have no organ or faculty to appreciate the simply given order. The real world as it is given this moment is the sum total of all its beings and events now.

But can we think of such a sum? Can we realize for an instant what a cross-section of all existence at a definite point of time would be? While I talk and the flies buzz, a sea-gull catches a fish at the mouth of the Amazon, a tree falls in the Adirondack wilderness, a man sneezes in Germany, a horse dies in Tartary, and twins are born in France. What does that mean? Does the contemporaneity of these events with each other and with a million more as disjointed as they form a rational bond between them, and unite them into anything that means for us a world? Yet just such a collateral contemporaneity, and nothing else, is the real order of the world. It is an order with which we have nothing to do but to get away from it as fast as possible.<sup>54</sup>

James goes on to recapitulate how we break it and make serial orders of it, how "we discover among its parts relations that were never given to sense at all,—mathematical relations, tangents, squares, and roots and logarithmic functions,—and out of an infinite number of these we call certain ones essential and lawgiving, and ignore the rest." They are essential for our purpose, which is to conceive simply and to foresee, "and the miracle of miracles, a miracle not yet exhaustively cleared up by any philosophy, is that the given order lends itself to the remodelling" (863n).



By so emphatically declaring miraculous the success of our mental constructions, and by admiring the plasticity of “the given order” in accommodating itself to our notions and ends, James heads off any impulse to grasp at an intrinsic congruence between our constructions and what is, or to give to our knowledge of what is objective standing. Even mathematical reasoning is obliged to relinquish authority, as James lays emphasis on the infinite number of relations we are capable of discovering in fragmented experience and the selective bias that governs our choice of what is significant. Consequently—as we have seen—when James’s starting point is the relation of numbers to experience, he cheerfully points out that “we must make more numerical continuity than we spontaneously find.” He concludes his account of number—before going on to geometry—with a left-handed compliment:

The modern theories of atoms, of heat, and of gasses are, in fact, only intensely artificial devices for gaining the constancy in the numbers of things which sensible experience will not show. “Sensible things are not the things for me,” says Science, “because in their changes they will not keep their numbers the same. Sensible qualities are not the qualities for me, because they can with difficulty be numbered at all. These hypothetic atoms, however, are the things, these hypothetic masses and velocities are the qualities for me; they will stay numbered all the time.”

By such elaborate inventions, and at such cost to the imagination, do men succeed in making for them-selves a world in which real things shall be coerced *per fas aut nefas* under arithmetical law.<sup>55</sup>

Science has been happy to find a congruence after the fact between the inventions of mathematics and “the real order of the world,” as in the classic instance of Riemann’s geometry and Einstein’s universe. But such coincidence did not prevent Einstein from declaring, aphoristically, “As far as the propositions of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.”<sup>56</sup> The “certainty” of mathematics in this formulation refers to its own internal consistency, established through the method of deductive proof that is doubtless the Greeks’ most fundamental contribution to that art or science. Unlike the operations of the natural world, such certainty is of the greatest concern in the world of pure mathematics, and, as we have seen, it has been shaken of late, in particular by Gödel’s demonstration of a formal inconsistency or irrationality in the structure of its thought, linked to the paradoxes of self-reference. But one could contrast the considerable interest evoked by Gödel’s proof with the alleged scandal of irrational number for the Greeks, whereby the geometry and rationality of the real world seemed to be obscurely threatened. At least for some moderns, Gödel’s mathematics seemed to have revealed intriguing new affinities with both art and our cognitive engagement with reality.<sup>57</sup>

Confidence in a practicable bridge between the real world and mathematical law allowed Einstein to persist in his belief in a universe that was not built upon what he considered chaos, that is, on chance, randomness, and discontinuity. But the perception of a gap was equally important in opening a space for skepticism toward the uncertainties of the quantum regime and the difficulty of bridging between quantum theory and relativity. Though he never ceased to act on the principle that, to be science, physical theory required the rigor of mathematical argument and demonstration, in the end Einstein did not pin his faith on the numbers, and in this he differed from such latter-day Pythagoreans as Werner Heisenberg (who only admitted to Platonism) and the late Richard Feynman, who brushed the problem of incongruence aside. For Feynman, as even his obituary reports,



“Mathematics was nature’s own language... ‘If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in,’ he said. ‘She offers her information only in one form; we are not so unhumble as to demand that she change before we pay any attention.’”<sup>58</sup> If one begins with the premise that nature speaks only in mathematics, there is no point in quarrelling with what she says about herself. And of that whereof the numbers cannot speak, one has to be silent. If, as in Heisenberg’s pithy formulation, “The equation knows best,” there is no point in feeling queasy over the impeccably derived and quantifiable notion of quantum uncertainty or even over the more radical assaults on the principles of contradiction and identity that follow.

However inured we have by now become to these mysteries, the transformation of applied mathematics from a stay against chaos to an instrument for its valorized installation did not go down easily at first. Heisenberg’s penultimate chapter in his reflective *Physics and Philosophy* takes up the violent reaction that relativity and quantum theory provoked, and it is appropriately titled “Language and Reality in Modern Physics.” Being able to use natural language to accommodate the world of physics to the world of human experience had been a frequent theme of Niels Bohr, the Heisenberg generation’s powerful mentor.<sup>59</sup> But Heisenberg speaks of the need for a transfigured common language, a vernacular that can cope with the ontology that mathematics as the language of science adumbrates. In a world of quasi-existences, “virtual” beings, and entities that embrace contradictory selves as coexistent potentialities, “it is especially one fundamental principle of classical logic which seems to require a modification”: that “either the statement or the negation of the statement must be correct,” and “tertium non datur.”<sup>60</sup> A modified principle of contradiction is the reciprocal of an enlarged notion of identity. Heisenberg, who in his apologetics is much drawn to paradox, writes elsewhere of a universe in which “Every particle consists of all other particles,” in which, given a dynamical ground state pregnant with an infinity of virtual particles in matter-antimatter pairs (Dirac’s universe), anything can happen at any time.<sup>61</sup> Where the numbers lead is to a ground state very like that which Sophocles’ Oedipus confronts and dismantles, in which the chaos of the many appears to be confounded in the indeterminacy of the one.

As an interpreter of the philosophical bearings of modern science, Heisenberg by no means stood still or sacrificed imagination to consistency. But his 1955 essay *The Physicist’s Conception of Nature* may stand as a touchstone statement (in which William James might have found some ironic satisfaction) of the implications of the new knowledge and his own work in particular, as rationalized in “the Copenhagen interpretation” of quantum mechanics. Heisenberg’s point is the unavailability to us, as the object of description, of something called “nature ‘in itself.’” Instead,

As a final consequence, the natural laws formulated mathematically in quantum theory no longer deal with the elementary particles themselves but with our knowledge of them.... Thus, the objective reality of the elementary particles has been strangely dispersed, not into the fog of some new ill-defined or still unexplained conception of reality, but into the transparent clarity of a mathematics that no longer describes the behaviour of the elementary particles but only our knowledge of this behaviour.<sup>62</sup>

In a later account of his intellectual travels, however, Heisenberg comes back to concern for a reality that can claim structure in its own right, at least to the extent of a fundamental

geometry like that in Plato's *Timaeus*. The difficulty as he sees it—as in the quest for a natural language that reflects the revealed ontology—is in the Aristotelian principle of identity and the division, with respect to objects and predications, between what is and is not. In a serendipitous stroke, Heisenberg takes up a theme that points back to the untoward similarities in the paths of creation and of confusion in *Genesis* and forward, however unwittingly, to a central concept in the cluster of insights cannily promoted as “the new science” of chaos. Heisenberg quotes a letter where Wolfgang Pauli wrote: “Division and reduction of symmetry, this then the kernel of the brute! The former is an ancient attribute of the devil (they tell me that the original meaning of ‘Zweifel’ [doubt] was ‘Zweiteilung’ [dichotomy]).” But Heisenberg subsequently reflects that Pauli's division, once one abandons Aristotelian logic, “introduces complementarity in a crucial place. Pauli was thus right to claim that division in Aristotle's sense was an attribute of the devil, that its continuous repetition can lead only to chaos.”<sup>63</sup> Roughly speaking, Niels Bohr's “complementarity” says that a packet of light may be, simultaneously, both a wave and a particle, or here and there, depending on how you look at it. On Aristotle's principle, Heisenberg argues, making two of one and dichotomizing in “continuous repetition” will lead to chaos, but with “identity” out of the way, making one of two may “lead us into the space of the real world.”

But then so might continuous repetition applied to division and multiplication, which, with reflexivity, played a leading part in the new science of chaos, an optimistic response to precisely those circumstances in the macroscopic world where “the applied mathematics is imperfect.” “Chaos” is invoked, but with a difference. Addressing itself to systems with too many players, systems where trivial events can have huge consequences and negligible variations escalate into enormous divergences, the science leaves unresolved the issue of the ground state of what is, though its program enables finding patterns, recurrences, and quantitative language for regions previously abandoned to chaos in the raw. In some of its discoveries it even lends support to the positive side of the question of whether there is an intrinsic congruence between the world of numbers and nature itself. Some of its clearest early successes, however, came in describing the transitions to chaos, where it turns out that buried in the phenomena are some relatively simple rules, including a sequence of bifurcations and a process of recursive iteration, fed-back numbers working on themselves. Even in simple systems with only a few elements to worry about—Tango comes to mind—iterative multiplication and division furnish the path from cosmos to chaos. But remarkably enough, in the turbulence and unpredictabilities that ensue, multiplication and division can also furnish the path from chaos to cosmos. Finite islands of order appear, as does a configuring focus that can be expressed geometrically as an orbiting curve around a “strange attractor.” So, in the beginning, says the Torah, while a wind roiled the face of the deep, the appearance of “light” in the featureless waste signaled the first term in a numbered, patterned, geometrically multiplying chain of accreting differentiations. In Nemerov's “Angel and Stone,” where complexity and the mind's limitations conspire to overwhelm sense, intellect, and even imagination, opening the prospect of chaos, it is the angels who are able to save the phenomena, that is, both the uniqueness and the complexity. The poem concludes:

So do they go, those shining creatures, counting without confusion  
And holding in their slow immeasurable gaze all the transactions  
Of all the particles, item by atom, while the pyramids stand still  
In the desert and the deermouse huddles in his hole and the rain falls  
Piercing the skin of the pool with water in water and making a million  
And a million designs to be pleasingly latticed and laced and interfused  
And mirrored to the Lord of everything that is by one and one and one.

# CARNIVAL

The other night, from cares exempt,  
 I slept—and what d'you think I dreamt?  
 I dreamt that somehow I had come  
 To dwell in Topsy-Turveydom!  
 Where vice is virtue—virtue, vice:  
 Where nice is nasty—nasty, nice:  
 Where right is wrong and wrong is right—  
 Where white is black and black is white.

—W. S. Gilbert, “My Dream,” *The Bab Ballads*

If one begins not just with something but with an ordered something, then the easiest way to the imagination of chaos is to turn that something upside down. But for such a strategy to be effective, the original order has to incorporate not just pattern and arrangement but a relational logic that is hierarchical and that appears to be fundamentally irreversible—like cause and effect, or “the Great Chain of Being,” or the arrow of time. The inversion will then appear oxymoronic, a paradoxical conceit, as when the beggar, who has nothing and is powerless, is king, and the king, who has everything and is all-powerful, must beg. It is not enough for chaos-as-inversion that the one become the other in the ordinary course of time, whereby the child may be father to the man and perhaps the last shall be first. They must appear to be each other at once: beggar and king, king and beggar, child and adult, in a kind of monstrous composite or chimera, where the true source of the sense of chaos lies in the assault upon relational logic.

Carnival is full of licensed monsters. Elsewhere monstrous composites are not infrequently characterized as a chaos or used to concretize the chaotic principle. In a world of categories and structured relationships, monstrosity is by definition transgressive. In its radical form, however, monstrosity not only violates the bounds, sacred and natural; it annihilates them, reducing the hierarchical and categorical to an unstructured, anomic, combinatorial diversity. Monstrosity implies both a transgressive extremity obliterating the norms and uncontrolled and uncontrollable possibility, so that the paradoxical result of an imagined universal monstrosity (monstrosity as the norm) is a kind of leveling. Where all is bizarre and all is possible, difference makes no difference.

Appropriately, carnival as an approach to the embodiment of chaos entails these two apparently contrasting strategies: the inversion of hierarchy and universal leveling. Yet the living and historical events we call “carnival”—not just those that mark the onset of Lent in communities following the Christian calendar but similar events in other societies that have put up with ethnographic scrutiny—these tell us that inversion of hierarchy and universal leveling (within a defined community) are not as mutually exclusive as logic would have it. In chaotic fact, the one schema promotes the other. A ritualized inversion of hierarchy in the carnival vein can promote a promiscuous mingling with leveling as an unintended effect. On the other hand, where leveling is the whole point, whether on political or religious grounds,

inversion of hierarchy may be the most effective rhetoric of enactment.

Leveling and inversion are apt to promote each other not only as a practical effect of undoing the received order but also because of a deeper challenge that lies in carnival, one closer to the bone if more abstract. The intrinsic moral may be that the a priori relational logic that undergirds familiar reality is not a priori after all but provisional and thus precarious (and perhaps in need of reinforcement). Or it may be that the hierarchical structure of the order of things does not include everything, that there are leveling commonalities shared by all, shared without distinction, such as mortality and mutability. Or the ultimate point may be that opposites, such as power and powerlessness, divinity and mortality, presented in an oxymoronic conceit, can transcend their ludic character (the guarantee of a return to the ordinary that is implicit in acknowledged nonsense, or counterfactual pretense, or licensed communal folly) and claim a superior reality: as the incarnate god, the Fool that is Christ, or the revolution that sublimates its leveling chaos in Liberty, Equality, and Fraternity.

Carnival exists first as an actual occasion, second as a class of analogous events, and, finally, as a generalized version of an alternative reality. The twofold interlocking carnival strategies of chaotic enactment—inversion and leveling—are analogous to a similar alterity in carnival time. Carnival occasions are often felt and sometimes formally designated as time out of time, an extracalendric limbo where whatever happens doesn't count. At the same time, carnival occasions are seasonal in their recurrence and seasonally marked. Like all festivals, they serve in themselves to articulate time in the seasonal progression of the year. As the anthropologist E. R. Leach put it, we create time by creating intervals in social life, and "Without the festivals, such periods [as the week, the year] would not exist, and all order would go out of social life." The markers, however, have to stand out and thereby cease to belong to the normal undifferentiated flow. With a bow to Durkheim, Leach proposes that "Each festival represents...a temporary shift from the Normal-Profane order of existence into the Abnormal-Sacred and back again." Moreover, the festal phase ought "in some sense" to be the reverse of the ordinary phase. "In that case a logically appropriate ritual behavior would be to play normal life back to front."<sup>1</sup>

Time out of time thus has a temporalizing function, and it "logically" manifests itself as inversion of the ordinary, even—as when the old play young or the dead come out of their graves—as the reversal of time itself. But here again, inversion can go hand in hand with leveling. Time out of time is also time without memory—a paradoxical notion, but a necessary condition where festal time is a period of general license and general exaltation. And indeed in its extracalendric character, sacred time is above such constraining supports as memory and history, giving entry to the oneness of eternity.

The carnival god could appropriately be Saturn, by virtue of his overthrow of Cronus (mistakenly identified with Time) as well as the Roman Saturnalia, or Dionysus, by virtue of festal leveling.<sup>2</sup> But a better claim could be made for the two-faced monster Janus, by virtue of his doubleness and embodied liminality. In Ovid's *Fasti*—a calendar poem, where each book of the six completed takes up a month's astronomical, historical, and religious events, its festivals and rites—Janus biformis appears in person to answer the poet's puzzlement over his double visage. Probably taking advantage of a speculative derivation of



his name (from *hiare*, with a root connection to chaos, suggestive of a splitting open as well as a yawning gap), Janus declares: "The ancients called me Chaos, for a being from of old [*res prisca*] am I." And he tells of the time when the four elements "were huddled all in one," and how, when the mass dissolved through discord, and earth, water, air, and fire went their ways and found their space in a layered vertical order, "'Twas then that I, till that time a mere ball, a shapeless lump, assumed the face and members of a god." But in Janus, something of the original condition remains: "And even now, small index of my [once] chaotic state, my front and back look just the same."<sup>3</sup>

The other, more obvious reason for his facing both ways has to do with his threshold position and the power and function of the gatekeeper, the opener and closer, notably at the gateway to the year. He explains that moment as special in being "the beginning of the new sun and the end of the old one."<sup>4</sup> To mark that specialness, as a time between, where beginning and end can live in contradiction, later centuries would shift the license and inversions that marked the December Saturnalia to the festival of the New Year. The power of the gatekeeper was also expressed in another link with chaos, in the Roman tradition whereby opening the gates of the Temple of Janus signified the onset of war.

Janus's chaotic ambiguity and double regard fit the transitive course of Leach's anatomy of ritual occasions. He distinguishes three types of unusual behavior on such occasions, seemingly contrasted but in fact related: one in which formality is increased; one in which official status and social personality are disguised rather than heightened; and one, embracing and transcending the other two, "an extreme form of revelry in which the participants play-act at being precisely the opposite to what they really are; men act as women, women as men, Kings as beggars, servants as masters, acolytes as Bishops." Leach labels these styles of behavior "formality," "masquerade," and "role reversal" and schematizes and connects them as phases of "sacred time": the first two (indifferently) as onset and offset, the third as sacred time's fullest realization. As the climactic phase, role reversal "is symbolic of a complete transfer from the secular to the sacred; normal time has stopped, sacred time is played in reverse, death is converted into birth" (136).

Two of Leach's generalized forms of ritual behavior, masquerade and role reversal, are pertinent to the strategies for imagining chaos in carnival dress, though the third, heightened formality in exaggerated ceremonial forms, has a contribution to make as it approaches self-parody. Taking them together, Leach presents role reversal, the phase between onset and return where the shift from secular to sacred is complete, as by far the most radical transformation of the established order. "In such situations of true orgy, normal life is played in reverse, with all manner of sins such as incest, adultery, transvestism, sacrilege, and *lèse-majesté* treated as the natural order of the day." It is arguable, however, that the most radical assault on the established order among the forms of festal behavior lies in what Leach calls "masquerade," where all the world goes in mask, "and the formal rules of ritual behavior are forgotten." Reversal, inversion, preserves a structure; masquerade, or leveling, dissolves it. Reversal constrains identity in paradoxical antithesis; masquerade releases it in protean possibility. Masquerade goes beyond the occasion of the fancy-dress ball that ends with an unmasking; witness the hoods and disguisings, including cross-dressing, of actual clandestine conspiracy, resistance, rebellion, vigilantism, and criminality.

And masquerade can obliterate identity as well as release it. Inversion is easier to restore to its original form—as when the carnival king is deposed at the end of the season. It is a mere flipping of the hourglass. But the effects of leveling, as with Humpty Dumpty, may not be so easily nullified.<sup>5</sup> At the limits, where all is possible and all is the same, where social life itself dissolves into the unpredictable and—to acculturated eyes—the unnatural, carnival fits the outlines of Thucydides' plague. The literary and pictorial associations between plague and saturnalia, plague and masquerade, carry that disturbing awareness, as in Holbein's *Dance of Death*, Boccaccio's *Decameron*, Poe's "Masque of the Red Death," Ghelderode's *Fastes d'enfer*. In Lucian's *Menippus*, a parodic journey to the underworld, the dead in masks and costumes offer a pageant of life, a masquerade that ultimately reveals an underlying equality, as bones.

In countless fictive embodiments, verbal and visual, of the carnival strategies for imagining chaos, three specific locales occur with notable frequency. These are the theater, the fair, and the dream. Such recruits from social and psychological experience feature aspects that make them appropriate vehicles for projections of a carnival anticosmos. The theater is conspicuously the place of role playing in a structured mirror world; the fair is a place of promiscuous mingling. The dream as representation, both freeform and conventional, uses substitutions, displacements, inversions, untoward condensations, to seem either alogical and antiexperiential, fluid and arbitrary, or structured according to an inverse and substitutional logic of its own—going, as folk wisdom would have it, "by contraries." Yet it would be a mistake to associate any of these settings—fair, theater, or dream—with an exclusive property in inversion or leveling, role reversal or masquerade, festivity or monstrosity. Accordingly, I intend to pursue their interplay in a number of versions of carnival chaos where the fair, the theater, and the dream are conjoined, sometimes all three in a single work. From these localized explorations, I will move to representations of a chaos that deploys a rhetoric, a representational strategy, best understood as parodic. Parody enlists forms of displacement to qualify similitude, wherein inversion may play a leading part. In parodic mirroring there is both a leveling claim and a ready partnership with the imagination of chaos as the world turned upside down.

Carnival as a social and cultural phenomenon has been much in the limelight in recent decades, thanks to powerful impulses from historians and others concerned with mentalities and marginality and with the underburden of experience, thought, and practice in populations that the official culture can never fully express or constrain. Among literary commentators, conceptual models from social and cultural anthropology and social psychology and the westward migration of the intellectually compelling writings of Mikhail Bakhtin have made "the carnivalesque" almost as pervasive a trope as "irony" was for a previous generation. The result has been a body of criticism, impressive in its proportions and variable in its quality, making extensive use of the notion of carnival, one of whose strengths comes from the fact that everyone knows what it is. Knows what it is despite a great deal of argument over its social and political function (adaptive or subversive?), its psychological roots, and its blanket application to an extraordinarily diverse and often incompatible set of phenomena. As a term of art, "carnival" has in fact become an uncomfortably rickety intellectual construct. Nevertheless—despite a tincture of sentimental

populism, or perhaps even because of it—Bakhtin's broad argument and concrete investigations, as in his undeniably brilliant work on Rabelais and Dostoevsky, remain a fertile source of suggestion and generalization.

Among Bakhtin's contributions is his perception that there is a historical dimension to what he calls "the carnival sense of the world." Accordingly, not only is there a carnival voice, rooted in corporate human experience, which enters into dialogue with the succession of official cultures; there is also an evolution in the sensibility that speaks through such a voice. In his historical conspectus, Bakhtin describes such an evolution: from antiquity, where the carnival sense had "an enormous place in the life of the broadest masses of the people" (witness the Saturnalia) and a powerful influence on literature; directly into the Middle Ages, where "it should be said (with certain reservations of course) that the medieval man lived, as it were, two lives: one was the official life...the other was the life of the carnival square"; and into the Renaissance, where the carnival sense achieved its climactic expression; followed by a decadence that left it a literary tradition, drawing its inspiration from literary sources (and so, "sentimental" in Schiller's use of the term) rather than directly from "carnival life." At its Renaissance height, the "carnival sense of the world," in its permeation of both high or official culture and popular experience, had an inclusive (even leveling) force when, in Bakhtin's account:

Its carnival laughter, its symbol-system of carnival acts of crowning/decrowning, of shifts and disguises, carnival ambivalence and all the overtones of the unrestrained carnival word—familiar, cynically frank, eccentric, eulogistic-abusive and so on—penetrated deeply into almost all genres of artistic literature. On the basis of this carnival sense of the world, the complex forms of the Renaissance worldview came into being. Even antiquity, as assimilated by the humanists of the epoch, was to a certain extent refracted through the prism of the carnival sense of the world. The Renaissance is the high point of carnival life. Thereafter begins its decline.<sup>6</sup>

It does appear to be easier to factor out the abundant carnival phenomena in the Middle Ages than in the Renaissance, where the "carnivalization" of so much literary and other expression goes hand in hand with an increased willingness among intellectuals to flirt with the possibilities of an uncontained chaos and with the suspicion of a fundamental instability in church, state, language, geography. At the same time, artists and thinkers, satirists and polemicists, could draw on established topoi, some with the authority of classical example as well as the familiarity of vernacular practice. One such schema, with an ancestry in both religious and secular tradition, was the wisdom of folly. Another was that of the "world turned upside down."<sup>7</sup>

## MONSTROUS CONFUSION

The world turned upside down was often represented in a single comprehensive emblem: a globe stuck with a cross pointing downward.<sup>8</sup> But both the pleasure and the didactic power of the trope lay in its particularized elaboration, in exuberant folly and monstrosity. Mechanical inversion of hierarchical relationships can of itself achieve the force of monstrosity, if not the amphisbaenic sting in the paradoxes of an Erasmus writing in praise of folly. The basic process may be seen in the crude but effective title-page illustration for

John Taylor's doggerel pamphlet of 1642, *Mad Fashions, Od[d] Fashions, All Out of Fashions, or, The Emblems of these Distracted Times* (1642). The illustration (fig. 4.1) is a compendium of variations on the theme often found in popular broadsides where, typically, children beat their parents, fish perch in the trees, the ox dismembers the butcher, the deer pursue the hunters, and women rule the roost.<sup>9</sup>

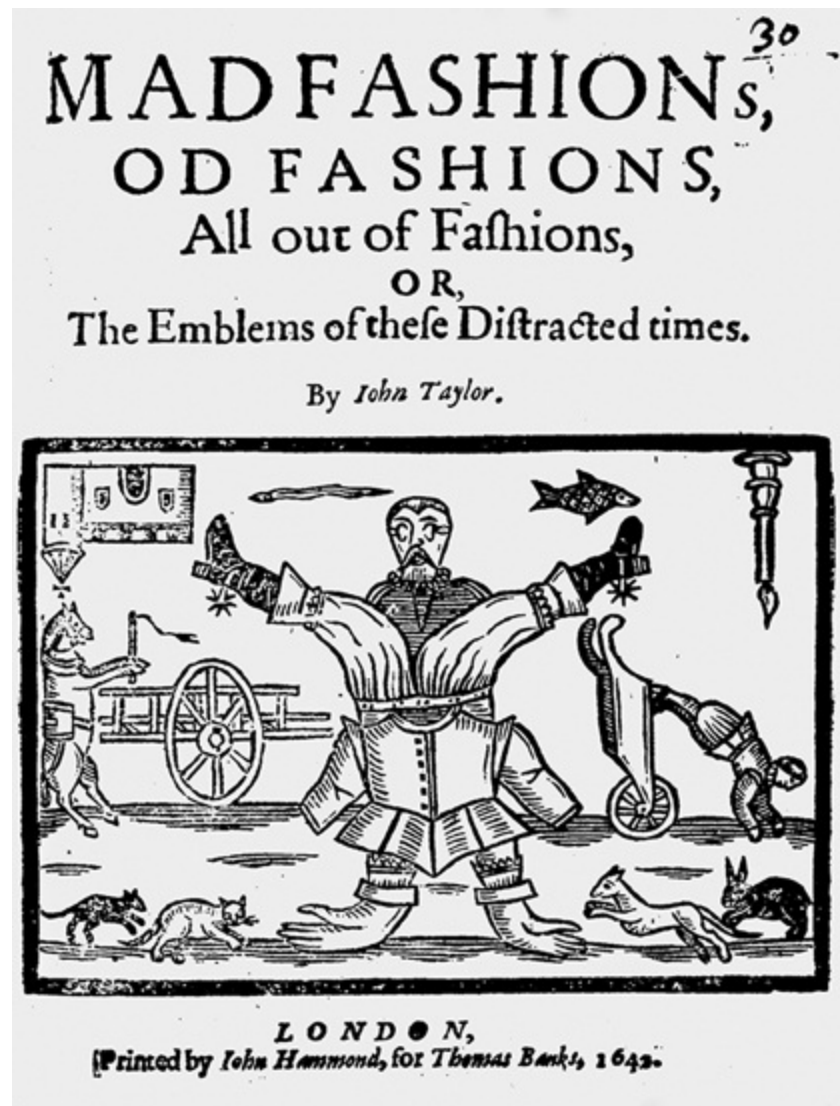


FIGURE 4.1. John Taylor, *Mad Fashions, Od Fashions, All Out of Fashions* (London, 1642), title page with illustration.

Such images united in Taylor's illustration add up to a systematically mad though notably symmetrical world whose central figure achieves, out of the folly of his literal cross-dressing, the effect of chaotic monstrosity. The scene is aimed at rendering the aberrant and "antipodis'd" condition of Britain in 1642 as changes in the established, or even the natural, order, inversions that seven years later would culminate in the suspension of the monarchy and the execution of the king. Taylor's vision doesn't carry him so unthinkably far, and his intent is satirical and restorative: to shame the nation out of its folly. He explains the scene in some detail, starting with the monster-fool-victim who in himself represents the confusion of the land:

This Monstrous Picture plainly doth declare



This land (quite out of order) out of square.  
His Breeches on his shoulders doe appeare,  
His doublet on his lower parts doth weare;  
His Boots and Spurs upon his Armes and Hands,  
His Gloves upon his feet (whereon he stands)  
The Church or'eturnd (a lamentable show)  
The Candlestick above, the light below,  
The Cony hunts the Dogge, the Rat the Cat,  
The Horse doth whip the Cart (I pray marke that)  
The Wheelbarrow doth drive the Man (oh Base)  
And Eeles and Gudgeons flie a mighty pace.  
And sure this is a Monster of strange fashion,  
That doth surpassse all Ovids Transformation.  
And this is England's case this very day,  
All things are turn'd the Cleane contrary way.

At a time when “Ignoramus will his Teacher Teach, / And Sow-gelders and Coblers dare to preach,” Taylor found a particular aptness in the proverbial folly of putting the cart before the horse. Equally apt, since his longest complaint is of the sectarian madness both in and out of the church, is the substitution of the inverted church, cross below, for the usual compendious emblem of the globe. Taylor’s apprehensions on the threat to the whole order of things when established religious authority is displaced had a problematic foundation in scripture. When Paul and Silas preach the new word at Thessalonica, they are pursued by a mob whose spokesmen then complain to the rulers of the city, “These that have turned the world upside down are come hither also...and these all do contrary to the decrees of Caesar, saying that there is another king, one Jesus” (Acts 17:6–7).<sup>10</sup> And behind that ironic account of incipient revolution is the verse that introduces what has been called the “Isaiah Apocalypse” (Isaiah 24–27): “Behold, the Lord maketh the earth empty, and maketh it waste, and turneth it upside down, and scattereth abroad the inhabitants thereof,” with consequences that are leveling in their universality, both for the earth and its inhabitants: “And it shall be, as with the people, so with the priest; as with the servant, so with his master; as with the maid, so with her mistress; as with the buyer, so with the seller; as with the lender, so with the borrower; as with the taker of usury, so with the giver of usury to him” (Isaiah 24:2). Taylor’s master image, however, is neither inverted globe nor steeple-down church but man-monster, observed and observer, from one point of view only a fool who doesn’t know how to put his clothes on properly but in immediate visual impact a compound of flippered seal and man, of inanimate suit of clothes and man, of two men fused head to toe and prepared for antipodean locomotion. No wonder his eyes are starting out of his head, in helpless amazement as much at himself as at the unhallowed perversities of the scene around him.

Carnival chaos, notably in the themes of the reversed world and the rule of folly, had a wide currency in the popular imagery of the previous century, in chapbook and broadsheet as well as in sophisticated humanist critique. Both the popular imagery and a measure of Erasmian irony find their way into the paintings and prints of Pieter Bruegel the Elder, whose oeuvre certainly lends support to Bakhtin’s account of the period. Carnival themes appear forthrightly in such paintings as *The Netherlandish Proverbs* and *The Battle of Carnival and Lent* (both 1559–1560).<sup>11</sup> But they are equally present in Bruegel’s print of *The Festival of Fools*, his painting of *The Land of Cockaigne*, and his representations of the



world of sin, madness, and violent apocalypse. Notable among these last are the prints in the series on the Seven Deadly Sins after his designs (1558) and the paintings *Dulle Griet*, *The Triumph of Death*, and *The Fall of the Rebel Angels* (all ca. 1562).

The immense respect accorded Bruegel's work in recent times has been accompanied by much recovered understanding but also a deepening sense of his complexity. Divergent accounts of his paintings, often quite plausible in their own terms, rarely give the sense that they have touched bottom. Interpretations resting on cultural contexts, market realities, or political, social, and iconological codes seem to leave intact the heart of Bruegel's mystery, some of which surely lies in the avoidance of a pictorial rhetoric of mystery along with, as Auden memorably perceived, an avoidance of the optics of drama.<sup>12</sup> The paintings seem to speak—as those of Bosch do not—of or to normality, as in the cool rendering, chilling in its effect, of the village raid called *The Massacre of the Innocents* (ca. 1566). With relatively small figures in a distributed action, an elevated viewpoint, an even winter light, a serene background, and a clear tactical account of how the affair is managed in the village square, the shock is in the matter-of-factness of the scene. Neither space nor scale nor light nor atmosphere is used affectively, to intensify the spectacle, to mobilize the spectator's feelings, to convey the explosive disruption of normality or its terror. Rather, the depiction renders the chaos as normality. Yet the effect is disturbing enough to have required the later substitution of domestic animals for children in the Hampton Court version, transforming the massacre into a scene of systematic foraging and looting.

Carnival appears in person in Bruegel's famous painting *The Battle of Carnival and Lent*, an interpretive case in point (fig. 4.2). The painting has been read plausibly and variously, as a critical representation of the religious polemics of the age, for example, with a Lutheran King Carnival and (en travesti) a Catholic Dame Lent, and alternatively as a visually structured representation of the whole sacred season from Christmas to Easter.<sup>13</sup> Both interpretations stress the centrality of the figure of Folly in the scene, as a kind of presiding spirit, though they choose different representations. (In one account it is the group with the torch-bearing fool leading the couple, almost at the physical center of the canvas, that strikes the keynote; in the other it is the elevated fool, sitting in the window overlooking the square, directly opposite the viewer and painter.) Folly is certainly pervasive in the crowded spectrum of oppositions and echoes, including the mock battle, that make up the scene; folly that is both general and, as it seems, taken for granted. Divisions break down in this highly symmetrical and ostensibly polarized scene, framed between Tavern and Church. There are children at play on the Lenten side, grotesque and alarming figures that give a penitential cast to the Carnival side, beggars and cripples on both sides. The painting offers both a spectrum of social life and an indiscriminate *mélange* of its elements. It combines revelation and masquerade, holiday and everyday, in a melding of festal and calendar time. Its featured mock battle marks a calendar threshold, phrased in extremes, but the total effect is to suggest the disturbing normality of the abnormal, and vice versa. Feast and famine, appetite and want, are not the mask of the ordinary but its face, and there is little that separates the ordinary world and the world turned upside down.<sup>14</sup>



FIGURE 4.2. Pieter Bruegel the Elder, *The Battle of Carnival and Lent* (1559–1560). Oil paint on panel.

Source: Kunsthistorisches Museum, Vienna.

In other Bruegel works the chaos that lies at the ready under the routines of ordinary life manifests itself as an eruption of a parodic antiworld. Baudelaire responds to their imaginative power in challenging “anyone to explain the diabolical and whimsical chaos [capharnaüm] of Bruegel le Drôle other than by a kind of special, satanic grace.”<sup>15</sup> Particularly in the monstrous fusions of incongruous forms, wit cushions the most disconcerting and horrific detail. In the painting *Dulle Griet*, for example, and the prints of the *Seven Deadly Sins*, distortions of scale, incoherence between surface and space, condensation, displacement, and inversion form a chaotic nightmare world. But it refers us always to the “normal” world, starting with the alarming personage of *Dulle Griet* (Mad Margaret) herself (fig. 4.3). Though she moves like a giant through the foreground, magnified against the nearby figures, she is nevertheless neither a compound monster, like the demon carrying the boat, nor an allegorical inhabitant of a symbolic landscape, like Ate, Bellona, or Wrath with torch, sword, and arrow-pierced brain. Rather, she is a single human being, individualized by name and appearance, a mad woman, armed and looting, who would be recognizable in a village setting despite the bizarre compound of her dress and armor, implying a kind of social monstrosity and the “unnaturalness” of her martial behavior, appropriate to a world turned upside down.



FIGURE 4.3. Pieter Bruegel the Elder, *Dulle Griet* (ca. 1562). Oil paint on panel.

Source: Image © Museum Mayer van den Bergh, Antwerp.

For in this apocalyptic painting—the whole sky is on fire, as at the end of the world—there are many of the conventional images of inverted order, such as the fish, natural and monstrous, swallowing a man, walking on land, and fishing; or the boat carried on the man-monster’s back; or, less conventionally, the upside-down monster trying to eat through its anus; the bird feeding on the entrails of its monstrous chicks; and above all, the militant women, armed, rioting, looting, bestriding, defeating the soldier demons: the women on top.<sup>16</sup> If there is room here for the modern argument that the world we see in the painting is the world of *Dulle Griet*’s chaotic imagination, there is still a better argument: what we see is folly’s true perception of a world possessed by the devouring passions and destructive violence of endemic war and by untrammelled greed and selfishness. The vision of a mad world is referable to the real world not as its antithesis but as its revealed self.

Among the monstrous compounds that inhabit Bruegel’s chaotic world, two stand out in the painting of *Dulle Griet*. One is the giant figure perched on the roof with the boat on its back, mostly human in form but prying gold from the open eggshell that forms its rump and anus. The broken, open eggshell is a common motif in Bruegel, and it appears several times more in this painting, once in the foreground under the fish-monster’s rod and once in the background in the giant parody of a wimpled head, with its compound projection of harp/spider web. The egg of the gold-defecating figure is echoed in the sphere clutched by one of the figures on its back. That in turn, with other spherical and hemispherical enclosures, is echoed in the lantern-like inhabited ball hanging from a curving mast in the upper left—the rod, fish, and egg in the foreground writ large. The shape of these spheres suggests the globe and an affinity between the hollow, broken eggs and the perverted world.

The other great monster is the satanic hell-mouth of the scene, a compound of Leviathan and architecture in the style of a ruined castle. In these composite images, the most powerfully expressive of the overall chaotic condition are those that unite the most



divergent species, the widest extremes. Buildings, inanimate manmade artifacts, serve such a design when they unite with the forms of animate, living nature, indeed, human nature, especially as expressed in face and head. Such monsters, like the brickwork demon, violently yoke the categories of nature and art, mental consciousness and material insensibility, and above all life and death. Bruegel's monster heads include the bizarre windmill in the Gluttony print (Gula) for The Seven Deadly Sins, an incompletely fused composite sharing the scene with a giant figure encased in something that is part prison, part rotary torture machine. In his Temptation of Saint Anthony print of 1556 (fig. 4.4), a giant, very human head lies on the water like a foundering craft. Smoke pours from its mouth, from which human figures bail; a small boat emerges from its tunnel-like ear and a brazier from its round compound eye of leaded glass. On its bandaged forehead lies a presumably decaying gutted fish, penetrated through its jaws by the branch of a tree in whose crotch it also lies and that may or may not stem from the monstrous head. Within the fish, it appears that two men are murdering a third. The loss of all bounds between animal, vegetable, and mineral, between species, orders, categories of being whose separation, naming, and elemental assignment were instrumental in creating the cosmos, is an extreme of carnival chaos, the nightmare of unholy mingling and unnatural monstrosity that bedeviled the religious imagination of the age. Given the prominent Christian symbols—including a flag with a cross on the tree that has spiked the gutted fish, open at the side—it is entirely plausible that this crucifixion, the most terrible of the saint's tormenting visions, is intended to speak to the condition of the Christian universe in the midst of the wars of religion, the body of Christ in extremis. (There is a church on fire in the background.) If so, it is worth noting that in the far middle ground, on a bank to the right, sits a peasant couple, embracing while fishing, in the shade of an ordinary tree, entirely unaware of the nightmare world before them—a point of reference, single and unexpected, to the “normal-profanal order of existence,” the world of Leach's everyday.



FIGURE 4.4. Pieter Bruegel the Elder, *The Temptation of Saint Anthony*, engraved by (?) Pieter van der Heyden (1556).

Source: Image © Sterling and Francine Clark Institute, Williamstown, Massachusetts, photo by Michael Agee.

Much of what belongs to a carnivalized dreamscape in Bruegel resumes a style and vocabulary identified with the creations two generations earlier of Hieronymus Bosch. Many of Bruegel's grotesque images have analogues and sources in Bosch, including even Bruegel's figure of Carnival mounted on a barrel.<sup>17</sup> In the case of Bruegel's compound monsters, there is a clear line between the open-ended rooftop figure in Dulle Griet and the extraordinary, even moving image of the hollow shell/dead tree/man-beast that dominates the infernal panel in Bosch's *Garden of Earthly Delights* (ca. 1503–1504; [fig. 4.5](#)). Boat-shod and bagpipe-crowned, its face invites rather than repels an affective reading for bovine suffering, malice, reproach, folly, and despair. The symbolism of self-torment is perfectly expressed in the sharp branches that penetrate the hollow trunk. The stripped, bone-white decay of the dead animal-leg tree trunks and truncated fungoid torso consorts obscenely with living consciousness. There is a further obscenity in the drooping bagpipes, reinforced by the image that lies beyond, the mindless phallic juggernaut of pinned ears and erect knife blade. In a triptych structured like a judgment scene (whose order has been described perceptively as an “increasing perversion, left to right,” and as an explosion through “this proliferation of things” into total disorder),<sup>18</sup> the shapes and instruments of procreation furthest from Paradise (or the prelapsarian world) appear in parodic, even death-dealing form. They populate a realm of monstrous confusion between life and death, the animate and the insensate, womb and cloaca, a culminating hellish vision of earthly chaos and of alienation from God's once unfallen order.





FIGURE 4.5. Hieronymus Bosch, *The Garden of Earthly Delights* (ca. 1503–1504), right panel, detail. Oil paint on oak.

Source: Museo del Prado, Madrid. Photo: Scala / White Images / Art Resource, NY.

Carnival inversion, the representational maneuver with which we began, may be thought of as a specialization within a wider array of departures from established normality, of escapees and mismatches unsettling the conceptual categories that give purchase on the world. Dirt, waste, and impurity are choice names for dealing with what doesn't fit or with what escapes its proper bounds (as "matter out of place"), becoming, as it were, categories at once outside and inside a classificatory system: carnival categories.<sup>19</sup> But the strong form of representing the anomalous and the transgressive, intimating chaos as vestige and as threat, adopts the language and imagery of monstrosity. The representation becomes most interesting when such monstrosity is offered as the paradoxical norm. That is what happens when, in a famous passage two centuries on, Pascal ponders the most familiar of oxymoronic monsters: "What a chimera, then, is man?" he asks or exclaims. "What a strange new thing, what a monster, what a chaos, what a creature of contradictions, what a prodigy? Judge of all things, imbecilic earthworm, repository of truth, sewer of incertitude and error, the glory and the refuse of the universe."<sup>20</sup>

## GOING TO THE FAIR

The topoi that give scope to both carnival inversion and carnival leveling as strategies for enacting chaos are exemplified in the hierarchical reversals of the world turned upside down, the transgressive yoking and excesses of monstrosity, the reciprocal displacements of wisdom and folly, and the promiscuous mingling of the carnival occasion itself. These and related motifs that help enact carnival chaos recur with great regularity in the alternative realities localized as Fair, Theater, and Dream. Two of these, fair and theater, have a place in the life of society and exhibit the public, communal character of the carnival impulse. The (il)logic and license of the insubstantial dream world, however, can release a measure of interior truth into the transformations of the mundane on offer in the other two vehicles, and in practice each often involves the others. Of the three, the fair is closest to the carnival festival itself, and like carnival—where mask, costume, role playing, and protean transformation are endemic—the fair in its long history has regularly played host to theater entertainments. The theater in the fair and the fair in the theater is the brilliant *donnée* of the reversible world in one of the richest early modern representations of chaos in its carnival clothes, Ben Jonson's *Bartholomew Fair*.<sup>21</sup>

The Latin ancestors of the words for “fair” (*feriae*) and “festival” (*festum*) come from one root; the same root, tangled in the sacred, to be found in “feast” and “fane,” “fanatic” and “profane.” The fairs of medieval and modern Europe grew up to serve a largely commercial function, as a gathering of buyers and sellers at a stated or customary time and place. But often they took place on festal days set aside from ordinary labor, on saint's days appropriate in season and association, and at places of pilgrimage with religious shrines. Thus the fair as seasonal holiday and the fair as a place for promiscuous mingling, drawing to it persons from outside the established community (even persons of no established community), went hand in hand with its character as a site of commercial intercourse and exchange. Its success could be measured by its difference from the everyday, its appeal beyond the strictly local, and the variety and abundance of its visitors, its goods, its activities. On the fair grounds and during the fair period, the fixed local order, with its confined and stratified relations, is temporarily superseded by a kaleidoscopic temporary society, one that can even seem an antisociety where nothing and no one appears to know its place.<sup>22</sup>

*Bartholomew Fair* was in its medieval origins a cloth fair held annually in Smithfield, London, a locale famous for butchery, ordinarily animal but in some instances human, as in the case of the “Smithfield martyrs” (1555–1558). The fair was held in the heat of summer, on St. Bartholomew's Day (August 24) and its eve and sequel, in Jonson's time a day also notorious for slaughter and fanaticism. Jonson—who at some period of his life converted to Catholicism—alludes almost casually and certainly comically (through the mouth of Justice Overdo, who is being stoutly beaten) to “the feast of the French Bartholomew, parent of the Massacre.” That event of 1572 represents the kind of carnival chaos—ostensibly launched to affirm a threatened order—that Jonson's carnival chaos is designed to work against.<sup>23</sup>

The first task of playwright and play is to define the protean stage. Jonson defines his stage, the world of his play, not simply as the annual fair in Smithfield but, in a special

sense, as the theater itself. The stage becomes “the stage” by virtue of an “Induction,” led off by the theater’s Stagekeeper followed by its Bookholder (Prompter) and Scrivener as themselves. Since the “play” they introduce will also contain a ‘play’ (albeit of puppets), the fair is in effect framed within the theatrical, which in turn it frames. The point, however, is not to create a nested set of discrete worlds with a hierarchical relation to reality but something less determinate. The fair is theater, and the theater is the fair.<sup>24</sup>

Promiscuity and inclusiveness are in the premises of the play, as they were in the institution of the fair. In the command representation at King James’s court the day after the play’s first public performance (1614), the induction was preceded, or more likely displaced, by a prologue where the king himself “is welcome to a Fair” and then warned what to expect. The comedy will include “the zealous noise / Of your land’s faction,” that is, the Puritans, who, however at odds with the established order, normally would shun the carnival scene. Yet though the incursion of the Puritan party is a seemingly indecorous addition to the comic miscellany of the fair, it is by no means out of keeping with the traditions of representation within the carnival world—witness the eponymous encounter in Bruegel’s *Battle of Carnival and Lent*. It is in the nature of carnival chaos that antithetical forces are included in its profusion, though often in parodic form.

King and faction are thus brought into connection via the promiscuity of the subject in *Bartholomew Fair*, but with a difference. The Puritans are brought to the fair and put upon the stage directly—“These for your sport” says the prologue to the king—but Jonson imputes the king’s presence only as spectator, overlooking and overhearing in benign if judgmental ubiquity. Jonson would have been foolhardy not to insulate James I from identifying with the chief magistrate of the fair, Justice Adam Overdo, whose claims to divine sanction are expressed by a certifiable madman and who subjects himself to carnival inversion—by disguising his refulgence in lowly garb—in order to oversee and overhear everything. The author’s proposed contract with his audience, spelled out in the induction, expressly forbids interpreting “what Mirror for Magistrates is meant by the Justice.” Nevertheless, commentators have wondered at Jonson’s putting a counterblast to tobacco in Overdo’s mouth, given James’s famous pamphlet on the subject, and at his characterizing Overdo as a politic ass whose folly is in his “wisdom.” Perhaps Jonson counted on James’s self-conceit to prevent any carnivalesque autoidentification. But that there is no record of any subsequent performance in the three decades before the revolution (and that the play is omitted in the ambitious first edition of his *Works*) might suggest that Jonson and the players had miscalculated.

The induction for the audience leads to one for the characters. The first act begins not in the fair but with the paltering among the Puritan faction on going there. The last ends, fittingly, with the prospect of leaving the fair, or rather of adjourning it (and the play) to Overdo’s house (“bring the actors along, we’ll ha’ the rest o’ the play at home”). Between onset and offset, the Fair, as compared to Jonson’s other greatest comedies, registers as “panoramic” not by virtue of an uninhibited spread in time and space but rather because of an absence of prioritized relations between characters and in the interweaving of events. One would be hard put to identify a protagonist, and though there are many agonistic oppositions, mismatched pairings, and developmental continuities, the dramaturgy itself



imports a leveling. The carnival, antinomian spirit of the fair, however, is produced in an array of inversions, many suggesting traditional motifs within the master figure of the world turned upside down. Among the most striking is the stage image represented by the direction, "They put [JUSTICE] in the stocks." Twice in the same act (4.1 and 4.6), Adam Overdo, justice of the peace and sometime magistrate of the special court responsible for order in the fair, having disguised himself as "A certain middling thing, between a fool and a madman" (2.2.130) in order to seek out "enormities," is stocked by the watch on suspicion of being in league with cutpurses. He believes his disguise impenetrable, and so it proves, perhaps because the reversal is less counterfactual than Overdo believes. Congratulating himself on his disguise, Overdo observes that "They may have seen many a fool in the habit of a Justice; but never till now, a Justice in the habit of a fool" (2.1.6–8). In adversity he comforts himself with stoic wisdom and the prospect of reversion to his true self. But for onlookers, that prospect is less assured since what Overdo in his disguise actually presents is neither a fool in the habit of a justice nor a justice in the habit of a fool but a fool in the habit of a fool, one of the effects of carnival dissolution being that folly, like truth, will out.

Other legacies of the world-turned-upside-down topos include the relations between Cokes, the all-agog young man from the country whose name means "fool," and his tutor and guardian, Wasp. The reduction of Wasp's authority culminates in the image of the tutor, led on by Cokes, carrying all the heaped-up trash his charge has acquired, evoking the upright donkey and the laden man in the popular broadsides ("You were best buy a whip i' your hand to drive me," says Wasp [3.4.8]). Still other reminders of topsy-turvydom are the cutpurse who warns the victims (in song) to protect their treasures, the night watch pursuing its functions by day, respectable women tricked out as—and nearly converted to—whores, women doing the courting, and old women matched with young men. Urging enterprise in pursuit of satisfaction, the rationalizing Littlewit even invokes the fancied fool's paradise Bruegel painted as *The Land of Cockaigne*: "Good mother, how shall we find a pig, if we do not look about for't? Will it run off o' the spit, into our mouths, think you? As in Lubberland? and cry, 'we, we'?" (3.2.66–68).<sup>25</sup> Like other charged locales in Jonson's comedies, the fair is a place of transformation where the latent follies of ordinary life are attracted, outed, and normalized while the norms are estranged and isolated. And so Dame Purecraft can say of the mad Trouble-All after he has assaulted the watch and inadvertently freed the godly hypocrite, Zeal-of-the-Land Busy, "Mad, do they call him! The world is mad in error, but he is mad in truth" (4.6.148–149). In the double sense of the last phrase, Dame Purecraft's declaration carries a vindication of the revelatory power of reversal and of Jonson's satirical bifidity.

Inversion, systematic or sporadic, as a strategy for displaying the regime of chaos is normally more concerned with hierarchy than scale. Monstrosity, however, describes both the transgressive union of disparates (Chimera, Griffin, Sphinx) and gross excesses in scale (Polyphemus, Gargantua, Fafnir, Leviathan). Overdo's obsessive quest in the fair is to spy out "enormities." The most blatant enormity is Ursula, the pig woman, who is also the closest thing to carnival queen, the Lord of this Misrule. Overdo describes her as "the very womb and bed of enormity! Gross, as herself!" and addresses her as "the fatness of the Fair" (2.2.95–96, 105). Zeal-of-the-Land Busy describes her as "above all to be avoided,

having the marks upon her of the three enemies of man, the world, as being in the Fair; the devil, as being in the fire; and the flesh, as being herself" (3.6.30–33). The carnival world is one in which the flesh, temporarily released from constraint and subordination, is made supreme. But Ursula, who is in fact much oppressed by the flesh and the fire, can manifest her enormity as the presiding genius of the fair in other ways. In a play replete with stage directions such as "They draw all, and fight," "They speak all together, and Wasp beats the Justice," "Here the puppets quarrel and fall together by the ears"—where swords are drawn and/or blows exchanged some eight times quite apart from verbal bouts and the quarreling game of "vapors"—Ursula monumentally erupts from her booth "with a firebrand" in hand, abuses her lean servant-fool Mooncalf for "drawing the air of pacification here? While I am tormented, within, i' the fire," and impresses the bystanders as an Ate or Alecto—as "Mother o' the Furies, I think, by her firebrand" (2.5.56–57, 61). Where inversion alone constitutes a chaotic world, it creates a parody of order. But where a leveling impulse enters as well, to break the confining structure of relationships, and inversions are reduced to local phenomena among the endless collisions and permutations, discord prevails, and chaos reverts to the realm of elemental strife.<sup>26</sup>

As an enormity in his own right and as a target of satire, much of Brother Busy's comic character lies in his deficient sense of scale or, more precisely, of moral proportion. Full of zeal against Popery and Idolatry, he attacks Leatherhead's toys and instruments as "apocryphal wares," and exercised at the sight of Joan Trash's "idolatrous grove of images, this flasket of idols!" he "Overthrows the ginger-bread" that is her gilded stock in trade (3.6.49ff.). When, later, crying "Down with Dagon," he attacks a puppet show as exemplifying "your stage-players, rhymers, and morris-dancers," he sees no absurdity, no disproportion, physical or otherwise, in entering into scholastic dispute with Puppet Dionysius (5.5). For Busy is in some sort a leveler, and the fair is for him "no better than one of the high places" (1.6.50).<sup>27</sup>

But the fair is if anything a low place, where mingling and festivity serve to bring down pretensions and uncover a common humanity. The cravings of the spirit are there translated into the imperious desire to eat pig, those of the flesh into a pressing need to urinate. To the mind and appetite of a Cokes, all its trash is equally desirable. To the thieves, it facilitates the (temporary) redistribution of wealth. For Quarlous, Winwife, Grace, and Dame Purecraft, it serves as a lottery of love. Win-the-Fight Littlewit, the respectable City Proctor's wife, is near won from her honesty to "do everything like a lady, hereafter; never know t[h]y husband from another man...Nor any one man from another, but i' the dark" (4.5.48–50). Invited by the genteel cutpurse Edgeworth—whose criminal talents he has enlisted—to share in Ursula's whores, Quarlous masters the insult by quoting to himself from Lucan: *Facinus quos inquinat aequat* (4.6.25–26); "Crime levels those whom it pollutes."

The climax in the leveling impetus of the fair comes with the reemergence of the overtly theatrical in Leatherhead's "motion," his puppet show. At issue are the normally ranked and bounded categories of experience and representation. Jonson in his induction has already allowed that his play is written to "the scale" of the lowest capacities, those of the groundlings (ll. 49–51), but has fancifully proposed that the right to censure be allotted



hierarchically, according to the cost of one's viewing place (ll. 75–87). Now, however, his fairground play within the play challenges even the distinction between action and representation, not to mention the decorum of styles and subject matter that normally structures representation. "The ancient modern history of Hero and Leander," translated into the puppet passion of a wench o' the Bankside, struck in love through a pint of sherry, and a dyer's son about Puddle Wharf (5.3.5–6, 102–108), is burlesque, the comedy of irreverent and reductive familiarization. In its performance, the lines of demarcation between author, audience, presenter, and actors are freely transgressed. The presenter and puppet master, Leatherhead, not only interpolates and explains but engages in dialogue and insult with his puppet actors and is twice beaten for his pains. Though he explains to a solicitous Cokes, "Between you and I sir, we do but make show," as far as Cokes is concerned, "we have seen't, and thou hast felt it" (5.4.254, 261). The startling ontological premise of Pirandello's *Six Characters in Search of an Author* is that fictive characters and real actors can inhabit a single continuum, the same "plane of reality," and interact (a premise that collapses in the last moments of the play). It is scarcely more paradoxical than that the human presenter, Leatherhead, standing alongside the play, and the puppet character Leander, acting within it, should interact. The capstone comes with the entrance of Busy, who is determined to disrupt the performance and to cast down Dagon, and who equates the Master of the Revels with the "Master of Rebels," Satan. Having accepted the puppet Dionysius (gowned as a schoolmaster) as his antagonist in formal disputation on the profane nature of the stage, Busy is discomfited and converted when Dionysius proves not only that the charge of transvestite abomination has no foundation (by lifting up his garment and showing "we have neither male nor female amongst us") but also that there is no difference between puppet performer and Puritan rabbin, both speaking by inspiration and scorning the helps of learning.

The highest flight of rhetoric in the play is Justice Overdo's after he reveals himself in all his glory, "the true top of formality, and scourge of enormity." Overdo halts "the motion" that bespeaks the puppet play and the motion that belongs to the fair. The stage directions have called for vendors and "passengers" who have no other function than to circulate; now Overdo cries, "Stay, now do I forbid. I, Adam Overdo! Sit still, I charge you" (5.5.104). He halts those slipping away and assigns all comers a place. The distraught Littlewit is directed to stand by the grave matron, his mother; Cokes and Wasp to "stand you both there, in the middle place; I will reprehend you in your course." Busy, Leatherhead, and the rogues are told to "stand forth, you weeds of enormity, and spread"; Ursula and Nightingale are directed to "stand you there, you, songster, there." Overdo creates out of the chaotic bustling scene a frozen, static array, a cosmos with himself as center, brought to a halt and awaiting the last judgment.

But Overdo himself is stopped in his tracks by the discovery of his wife, miserable and sick in the mask and courtesan's gown of "my Lord Mayor's green women," and it is left to Quarlous, stepping out of his masquerade as the madman, to set all in motion again until the adjournment. He tells Overdo to "stand not you fixed here, like...the whipping post i' the Fair," but to take his wife out of the air, "and remember you are but Adam, flesh and blood!" (5.6.86–89). The end with its unmaskings and exposures is restorative of the normal world,

but restoration by no means precludes changes in fortune and condition, including changes in moral condition. Overdo, for one—whose grand design of achieving omniscience and enhancing control through inversion and disguise has been stood on its head—has had a salutary experience.

The leveling force of Jonson's satire reminds all and sundry of their common humanity ("remember you are but Adam") and of mortal and institutional fallibility. In so far as it is directed at the Puritans, it exposes their assumption of moral superiority as hypocritical and casuistical, a masquerade productive of noise, dissension, and monstrosity, the marks of true chaos. But nothing in the play argues for a society that is unstructured or indiscriminate. The leveling promiscuity of the fair produces the chastening and revelations conducive to the restoration of a proper civil order. The compendiousness of Jonson's satiric purview and his immense enjoyment of certain kinds of vital and imaginative energy, however subversive of good order, should not be construed sentimentally, nor should the argument for restraint be measured by the representatives of the Lenten spirit in the play. As it turns out, there is no true Lenten spirit in Jonson's Puritans. Moreover, when considering both the authorial politics and the actual effect of the play, it is worth remembering not only that the Puritan sensibility was hardly in charge of culture and values but that the Puritans were still much likelier than their more worldly opponents to be the targets of repression in James Stuart's England. Jonson's ungoverned chaos does indeed present a brief for tolerance of the human propensity to enter into folly and to eat pig, but it makes no brief for antinomian anarchy or for those who would overturn the established order. In offering up the Puritans for James's sport and, more subtly, in ridiculing the zealots of the established order who overdo and so help bring on the very things they abominate, Jonson was doing his mite for stability.

\* \* \*

The established order is the real chaos in Bunyan's inversion of Jonson's critical perspective. The fair in *Pilgrim's Progress* is not a special place, a festive alternative to the mundane, but rather the epitome of the mundane, seen in the light and against the order of eternity. The miscellaneous inclusiveness of the generic fair, its turmoil, license, and ephemerality, both in show and substance, give warrant to its use as an emblem of secularity. Bunyan's fair is not in the world, but—as Jonson's *Zeal-of-the-Land Busy* would have it—the world is in the fair, so much so that it is the fair: Vanity Fair. But Vanity Fair's denizens deny its intrinsic carnival attributes of heterogeneity, turmoil, and ephemerality. Instead they conceive and present it as order.

In a number of crucial respects, Bunyan's fair does not conform to the model of the generic fair. Most important, it has been instituted, by Beelzebub et al., the proper lords of the fair, "that it should last all the year long." As such, it forgoes the special character and privileges of festal time. It is neither extracalendrical nor cyclically recurrent; it is merely chronic. In the author's scheme, festal time, or time transcended, is reserved to another sphere.

For the denizens of the fair, however, that which by nature is ephemeral is conceived as

permanent and ordinary, and that which is external to the fair, the world whose values the pilgrims represent, is regarded as bizarre or nonexistent. Similarly, the heterogeneity and inclusiveness of the generic fair is reversed into homogeneity and xenophobia. The fair, which, constrained by its mundane vision, offers itself as order, dissolves into chaos about the pilgrims because of their raiment and language. They seem “fools,” “bedlams,” “Outlandish-men,” “Barbarians each to the other,” with the result that “At last things came to an hubbub, and a great stir in the fair; in so much that all order was confounded” (90). The guardians of order conclude that these strangers by whom “the fair was almost overturned” are “Bedlams and Mad, or else such as came to put all things into a confusion in the fair” (91). Speaking for a confusion institutionalized, where the voice of truth can confuse the confusion, the guardians have a point. Indeed, the pilgrims are eventually tried for their lives because their presence and punishment provoke differences among the natives, who “fell to some Blows, among themselves, and did harm to one another” (91). The pilgrims are arraigned as enemies and disturbers of the trade of the fair, persons who “had made Commotions and Divisions in the Town, and had won a party to their own most dangerous Opinions, in contempt of the Law of their Prince” (92–93). Here is no Jonsonian argument for an enlightened stability. Rather, in this world—seen from the outside—turmoil is an improvement on consensus, faction serves the good of the whole, and contempt of the law means obedience to a true order and witnessing for the truth.

In dramatic terms, the pilgrims’ encounter with Vanity Fair in Bunyan’s narrative replicates the Puritan’s encounter with Bartholomew Fair in Jonson’s play. Like Zeal-of-the-Land, Win-the-Fight, and their party, Christian and Faithful invade the fair and are exposed to its wares and pleasures. They are perceived as strangers, their presence is disruptive, and they fall foul of the agents of the law. They are drawn into a formal polemic, scholastic in Bartholomew Fair, forensic in Vanity Fair, and the most outspoken member of the party, impelled by an active faith to testify to the wickedness of the fair, is severely punished. Busy was stocked; Faithful is caged and executed. The structure of the situation, very common in drama, is the same in the two works: intruders into the “normal” state of things disrupt it by their very presence and oddity. The difference in the outcomes—purgation as opposed to incorporation—follows from the view taken of that normal state. Zeal-of-the-Land, entering disruptively into the festive disorder of the carnival world, only adds to the confusion and miscellany. Confuted and subdued, he can readily be incorporated into the holiday alternative to the society that the fair temporarily displaces. Faithful, as a vessel of truth and conscience, has no future in a world that takes its tinsel for gold, its anarchy for order, its collective aberration for the permanent, universal norm.

To validate the metaphoric substitution of the fair for the world, and to exploit it, Bunyan develops the congruences. But Bunyan’s relation to his putative readers is such that he is loath to risk misunderstanding, and so, in his allegorical practice, the fiction of substitutability yields to the honesty of likeness in difference. He practices, in other words, a form of double exposure, where his metaphor’s tenor is not concealed in the vehicle. Accordingly, he points out that just as in other fairs you have rows and streets named for the goods there vended, so in Vanity Fair “you have the proper Places, Rows, Streets, (viz. Countreys, and Kingdoms)” where the appropriate wares are found, and “as in other fairs,

some one Commodity is the chief of all the fair, so the Ware of Rome and her Merchandize is greatly promoted in this fair.”<sup>28</sup> His subsequent catalogue of what Vanity Fair has to offer is metaphoric in its general designation of “merchandize” for sale but literal in its elaboration: “Therefore at this fair are all such Merchandize sold, as Houses, Lands, Trades, Places, Honours, Preferments, Titles, Countreys, Kingdoms, Lusts, Pleasures, and Delights of all sorts, as Whores, Bauds, Wives, Husbands, Children, Masters, Servants, Lives, Blood, Bodies, Souls, Silver, Gold, Pearls, Precious Stones, and what not” (88). The list itself leaves no room for mistaking, but in its cumulative energy, its inclusive promiscuity, its flaunting of scale and categorical bounds, it achieves a chaotic momentum leveling in its variety and multitudinousness. As the esteemed goods of the world are named, their trashiness is affirmed by the epithet “Merchandize” and the equalizing miscellaneousness. At the point where the tumbling catalogue seems to whirl out of control, it suggests the torrential copia of Rabelais.

Vanity Fair is the world, and the world, in what it parades as its order, is a world turned upside down. It is a fair that lasts all year long, a fair where all things frivolous are given value and the things of true value held worthless. Its visitors are construed as its monsters and its spectacle, and in its courts the villains constitute judge, jury, and witnesses while the innocent are the accused and the guilty. Faithful speaks out for the truth, and Mr. Blind-man, the jury’s foreman, declares, “I see clearly that this man is an Heretic” (96). It is the world of Bunyan’s experience, the reversed world of the Caroline Restoration, so fallen into obstinate perversity, so blind and resistant to God’s plan, that it can only be imagined as diabolical in its inspiration and arrangements. Like Milton’s Pandæmonium it is a form of institutionalized disorder, parodic and delusional, and Bunyan excludes any worldly-wise accommodation with such chaos in the interests of order and stability. A genuine revolutionary text, as Shaw and others have recognized, *The Pilgrim’s Progress* rejects any attempt to justify the established laws, institutions, and authorities as part of a divinely instituted order. Instead, it projects a moral landscape and the existing secular and religious society as a chaos to be traversed and resisted under the inspired order of grace.

## DREAMWORKS

Bunyan’s *Pilgrim’s Progress*, the full title declares, is *Delivered Under the Similitude of a Dream*, and when a portrait of Bunyan was added to the third edition (1679), it showed him asleep, propped conventionally on one elbow, with the Pilgrim behind and above, on the path leading away from the City of Destruction (a city that originally bore the label “Vanity”).<sup>29</sup> The dream convention in literature and art often serves, well or badly, to naturalize the unnatural and to license the fanciful, the bizarre, and the disturbing for the reader or viewer, as “only a dream.” It does more than that, of course, for it brings from the experience of dreams and their place in many cultures some sense of a privileged look into a reality beyond or beneath the ordinary reality, clues to an order that may be glimpsed only in special states or by special intelligences. As such, the dream convention offers an alternative to ordinary life and normal experience. But like carnival with both its systematic

inversions and its promiscuous inclusiveness, it can also offer an imagined chaos that is at root ordinary life, ordinary life unveiled.

Chaos represented through the dream world could take the form of inversion, but it also could manifest itself as unconditioned and arbitrary forms of combination and relationship, or even as the fluid dissolution of form itself. In the latter case, the chaos lies in the phantasmagoria, where the dissolution of stable forms, the distortion of scale, the compromise of identity in combinatorial liberty, produce a shifting and vertiginous mental landscape. Systematic inversion in the dream representation creates paradoxes of identity within an apparently stable alternative world. Phantasmagoria creates an incoherent extension of the ordinary world, full of temporary monsters and familiar fragments defamiliarized. It can be more disconcerting than inversion, for it suggests chaos exists in the ordinary world just beyond where one is looking, ready to appear where and when concentration wavers, lurking in wait for the sleep of reason.

The common human need to postulate a reality beyond the appearances, a reality that offers the framework of a meaningful moral order, generated the truisms, so frequently linked in Renaissance discourse, that “life is a dream,” and “all the world’s a stage.” Postulating a truer, realer order as lying outside the experiential world, but serving as its reference, produces a host of paradoxes, not least with respect to representation. The license of the stage to be other than itself is especially hospitable to representing alternatives to what is, and both the fiction and reality of dreams lend themselves to projections of what is not. “Dream” and “stage” are of course convenient shorthand for the illusory. But their relation to life and the world cuts two ways. Both theater and dream are by nature provisional: the play ends with an unmasking and a return to the ordinary, the dream with an awakening. Brought forward, however, both theater and dream are used to assert that the provisional state and the “ordinary” state are ontologically indistinguishable.

The dream as a world of inversion, but one with a claim to reality that competes with that of the ordinary world, found special favor in the baroque theater of Shakespeare and Calderón. And in their drama, as in that of lesser lights, the point about dreams is made in a theatrical setting that would be easy to take for granted, except that theater as place and performance is brought directly before the mind and thematized. The trope appears in the broad comedy of *The Taming of the Shrew* and with intimations of unfathomable intricacy in *A Midsummer Night’s Dream*. The first carries a structural kinship with the most successful of the overtly philosophic imaginative embodiments of the theme, Calderón’s *La vida es sueño*, or *Life Is a Dream*.

Most of *The Taming of the Shrew* is a play set within a framework play whose protagonist has his world turned upside down so suddenly and effectively that the only plausible explanation is dream or madness. While drunk and asleep, the beggar or tinker Christopher Sly is picked up by a prankster magnate and is clothed, servanted, wived, and persuaded that he has been out of his senses these fifteen years but is now newly restored to himself. “Persuade him that he hath been lunatic, / And when he says he is, say that he dreams,” instructs the real lord. “Am I a lord, and have I such a lady? / Or do I dream? Or have I dream’d till now?” asks Sly.<sup>30</sup> The play about the marriage of Katherina and Petruchio is performed for his lordship’s entertainment and further amendment by a



traveling company of players, fortuitously arrived. Seated “aloft” with some of his deceivers, Sly makes a muddled, nodding audience and—notoriously—disappears from the only acceptable Shakespearean text before the end of the first act. However, in a version of the play close to Shakespeare’s and variously regarded as a proximate source or (more credibly) a patched playhouse reconstruction of Shakespeare’s *Shrew* in earlier form, Sly remains audibly present, and his carnival lordship is brought to the conclusion that expectation looks for.<sup>31</sup> The narrative pattern of “the sleeper awakened”—transported out of his ordinary world into another life and then as suddenly and bewilderingly returned—is a worldwide motif and a European commonplace in Shakespeare’s time.<sup>32</sup> In the parallel *Taming of a Shrew*, the prankster lord concludes the joke by directing that Sly, now asleep, be taken up, “And put him in his [own] apparell againe, / And lay him in the place where we did find him” (103). Awakened at dawn outside the alehouse, Sly tells the tapster, “thou hast wakt me out of the best dreame / That ever I had in my life”—though he has learned, in case his wife objects to his absence, “how to tame a shrew” (108). For the audience too, any stirrings of epistemic uncertainty dissipate with the morning light. It is indicative that Sly in *A Shrew* has some trouble keeping in mind the fictivity of the play he is witnessing but has never a doubt, when he wakes on the cold ground to find the players gone and himself anything but a lord, of the solidity of the ordinary. His “dream,” which in many forms of the story deposits a residue, has taught him not philosophy (the vanity and ephemerality of this world) but domestic politics.

If a carnival inversion, where the beggar becomes temporary lord of the scene, is the principal event of the frame, patterns of inversion that recall the motifs of the world turned upside down mark the unfolding of the inner play. Relations between the sexes and the generations are always much to the fore in the inverted world, and in her character as virago—choleric, physical, willful, and direct—Katherina is, in her social world, the emblem and agent of chaos, the roadblock on the well-ordered path to sanctioned domestic union, and the living refutation of patriarchal authority. To restore “peace...and love, and quiet life, / An awful rule, and right supremacy” (5.2.109–110), Petruchio fights fire with fire (2.1.132–133). That is, he adds to the chaos, displacing Katherina as Lord of Misrule. He soliloquizes his topsy-turvy strategy: “Say that she rail, why then I’ll tell her plain / She sings as sweetly as a nightingale” (2.1.170ff). His lies overcome her truth, his violence her violence (her father accepts his false report of Katherina’s secret compliance, in place of her vehement rejection of Petruchio before his very eyes). He comes late to his wedding (he “woo’d in haste and means to wed at leisure,” says Katherina) and comes dressed as a ruffianly beggar in new hat and old breeches, worn-out mismatched boots, rusty broken sword, on a crazed Rosinante of a horse and attended by a lackey, “a monster, a very monster in apparel,” with everything mismatched and inappropriate (3.2.41–69). Moreover, he turns the solemn marriage vows into a tavern oath and carouse, as if in the burlesque marriage ceremony of a carnival king and his slut. A hint of the charivari, that carnivalesque remedy for masterful wives, complaisant husbands, willful girls, and other aberrants,<sup>33</sup> appears in the report of the couple riding home, master behind mistress, and of Katherina being thrown in the mire on the way (4.1.60–75). But Petruchio’s proper tactic—abetted by starvation and sleeplessness inflicted in the name of “reverent care”—is fear, to act a dangerous

madness in outdoing Katherina in choler and captiousness. In the final stages of obedience training, Petruchio practices an inverted misnaming of things—sunlight as moonlight, an old man as a fair young woman—and when Kate can follow his erratic turns graciously and wittily, she proves she has mastered her lesson.

Inversions punctuate the second plot involving Katherina's sister, Bianca, and when it comes to marrying, it is the intractable daughter who follows her father's command while the docile daughter follows her own whim. To a serious eye, the broad comedy of inversion can carry a lesson on the false security of a world so easily upset, where fathers are displaced not just from authority but (in one instance) from their very selves, where nothing can be counted on to keep its place in the order sanctioned by custom and nature. However, as one of the characters remarks toward the end—a formula Katherina repeats and interrogates—"He that is giddy thinks the world goes round" (5.2.20, 26). As it turns out, the alarming leap into chaos perpetrated by Petruchio, compounding that already loose on the scene, is no more than a successful homeopathic experiment. Good order, "natural" and social, is restored, and the play culminates in images of reassurance, of the world turned right side up, in festal harmony.

A similar social and domestic moral enters into *A Midsummer Night's Dream*, but the quality of the dream is different, and so is the imagined chaos. The dream state is equally metaphoric—events are assigned to the category of dream by the actors because they stray so far from the ordinary. But the fundamental strangeness does not depend on inversion, and the result is phantasmagoria. The term itself belongs to the age of the French Revolution, coined as the name of a magic-lantern show that used light, sound, back projection, resinous smoke, and aromatics to create an illusion of unstable forms, materializing and dissolving, changing size and shape, fusing and separating with uncanny effect.<sup>34</sup> Boundaries, continuities, and oppositions usually taken for granted, such as large and small, near and far, shadow and substance, natural and supernatural, gave way to a fluid and erratic series of changes where both physical laws and categorical distinctions were lost. The phantasmagoria, for all its character as a mechanical, commercial spectacle, had a particular affinity with the sensibility and aesthetics that met in high romantic art, and it is hardly an accident that *A Midsummer Night's Dream* came into its own in the nineteenth century, in productions, in canonical standing, and as a shaping stimulus to musical and pictorial art.

Not that *A Midsummer Night's Dream* is a nineteenth-century play. Certainly it cannot be said to encourage an ideology that exalted the untrammelled imagination, at least not intentionally. Indeed, the chaos it projects, harmless as it proves to be in the end, is a chaos of the imagination, ripest in the phantasmagorical wood, the nighttime wilderness where different orders of being converge and mingle, stirred by an embodied spirit of confusion and a love that is not yet harmony but "the impression of [one's] fantasy" (1.1.32). In the lovers' arbitrary and accidental shifts and recombinations, the drug-induced form is indistinguishable from the "true love" that in Lysander's famous description is "momentary as a sound, / Swift as a shadow, short as any dream, / Brief as the lightning in the collied night" (1.1.143–145). In the wood, scale is lost, as are temporal measure and solidity. A figurative ass made literal man-monster consorts with spirits and is found lovely in at least

some of their eyes. In driving the mechanicals from the wood, Puck projects the multiform terror of nightmare (3.1.101–106), and in preventing the showdown of Lysander and Demetrius, however comic their frustration, he creates the “dark uneven way” of a shifting, unfathomable labyrinth. Time, place, and proportion are restored only with the coming of light, when, Oberon predicts, “all this derision” and the night’s “accidents” shall seem to the exhausted sleepers, newly awakened, “But as the fierce vexation of a dream” (3.2.370–371; 4.1.67–68).

Sleep, here again, is not simply a concomitant of dreaming but a bridge allowing the equation between the waking world and the dream world to be drawn, fostering a vertiginous uncertainty. The newly awakened Demetrius needs the confirmation of his fellows to conclude that his current state is the waking one (though that the lovers have had “all their minds transfigur’d so together” [5.1.24] puzzles Hippolyta). That both experiences could be waking states never strikes Demetrius, nor does it strike Bottom. Bottom never doubts that his night experience was a dream, but he expresses the giddy chasm such experience opens up through his temporary inability to find words for it, for it is a dream that “hath no bottom.”

The mechanicals’ hilarious play of Pyramus and Thisbe, enlisted to abridge the time between the weddings and bed, represents in the schema of the whole not another flight of the unbridled imagination, this time tragic, but rather its earthbound defect, requiring an audience to piece it out with their own imaginations (5.1.208–210). And it is the actual audience that is slipped into Sly’s place in the plaudite that ends the play. Dream and play, dream and theater and reality, are now equated, but in imagination. Theseus has condescendingly observed that even the best plays are but shadows, and Puck now asks, in his ever-quotable lines:

If we shadows have offended,  
Think but this, and all is mended,  
That you have but slumber’d here  
While these visions did appear.  
And this weak and idle theme,  
No more yielding than a dream.

(5.1.409–414)

Much of the social and even elemental chaos evoked and described in *A Midsummer Night’s Dream* has been (to borrow again from Theseus, on the prologue to “Pyramus”) “like a tangled chain; nothing impaired, but all disordered” (5.1.124–125). By the end of the play proper, the tangled chain of loves and confusions, so extravagantly developed in the wood, is all sorted out. But it would not be too much to find in Puck’s graceful, self-deprecating farewell—with night again coming on—a suggestion of something that passes the logic of mere combinatorial disorder, a gesture toward an epistemological and even metaphysical doubt on “seeming” that daylight cannot wholly dispel, like that evoked in Calderón de la Barca’s *Life Is a Dream*.<sup>35</sup>

The imagined chaos of the great baroque master's *Life Is a Dream* is that of the fallen world, the hiatus between creation and redemption that the primitive chaos has rushed to fill. It is a world of antithesis and impasse, marked by inversion, monstrosity, disjunction, as between intention and outcome, will and reason, and by confusing conjunction, as between birth and death, living and dreaming. And it is out of such chaos that a comprehensive higher order, created anew, will have to be born.

The primary plot concerns Segismundo, a king's son, whose father, Basilio, reads in the stars a catastrophic fatality: the son will be a monster of cruelty and impiety, precipitating civil destruction and trampling his father underfoot. Brought up in a solitary wilderness prison, enchained and ignorant of his identity, Segismundo is translated (like Sly) to the king's palace on his father's orders as a test of his nature, and he wakes as heir to the throne. But having decisively failed the test, he is returned to his prison, where the glorious interval is explained as only a dream. But the story is not over. The first *jornada* has shown Segismundo chained in his tower amid the rocks; the second, Segismundo invested with his rank in the palace and then returned to his abject condition; the third is yet to come.

Inversions are the order of the day. Attempting to avoid the chaos of a violently transgressive disorder—the son dominant over the father as predicted, animal ferocity in the place of reason, the kingdom as a scene of discord and vice—Basilio (as in the Oedipus story) helps bring it all about. Basilio fathers the chaotic spectacle of a rightful prince reduced to a beast, wearing animal skins and in chains. The action then provides a carnival reversal, where the image of man in his lowest state is raised to the heights as king for a day, when Segismundo is given his will. The multiple turns—and there are more in store—are elaborated beyond the usual carnival cycle, in a baroque structural analogue to the pervasive trope whereby Calderón suggests a labyrinth as the image of the world, a labyrinth where natural, unassisted reason “cannot find a thread,” a “confused abyss” full of portents, where the monstrous and prodigious are at home.

The chaos of such a world is embodied both in the action and its metaphoric framing, the former as a chain of impasse situations incorporating ethical and empirical puzzles that reason on its own cannot resolve.<sup>36</sup> The metaphoric framing is supplied both visually and in the poetry, with its elaborate and highly formalized patterns of versification and figuration. These create meaning by indirection and also, as happens so often, serve to contain the chaos.

The opening note in Calderón's *comedia* incorporates a drawn-out metaphor invoking elemental chaos. On the rocky heights overlooking Segismundo's prison tower, there appears a young woman clothed as a man, who addresses the animal—presumably her horse—that has led her into what she calls this “confused labyrinth of these naked rocks.” “Hipogrifo violento,” bespeaking a compound monster, part horse, part lion, part eagle, are the first words of the play. Rosaura—a courtier's compromised daughter in a subplot plumbing the labyrinth of honor—then extends the image, into “ray without flame, bird without color, fish without scales, brute without instinct”: four beasts in one, in precipitous turmoil. The opening thus conflates two kinds of reversal—man as woman and animal as master—with the imagery of the monster-haunted labyrinth and, in the epithets for the headlong beast, four creatures each native to one of the four elements, each paradoxically



and unnaturally devoid of its distinguishing attribute. Fire, air, water, and earth, half formed and at odds with each other, was the by now thoroughly conventional, quasi-classical account of cosmic chaos, bound here within a formal poetics of elaboration and exhaustive parallelism.

The poetics of indirect, parabolic representation of spiritual meanings, tied to the rich tradition of biblical hermeneutics, survived the counter-reformation's modifications in Calderón's philosophic plays such as *Life Is a Dream*, but as in other instances, Calderón revisited the themes of his profane comedia in a symbolic, transcendental redaction, using the same title and addressing the same issues but with the abstract figures of allegory (Will, Love, Man) unmasked. Two versions of Calderón's auto sacramental called *Life Is a Dream* exist. The earlier, found only in manuscript, opens with "la Sombra," Darkness, or Shadow, atop a rocky crag, all in black with a starry mantle, announcing himself:

I am the black shadow  
of chaos, whose pallid face frightens  
the heavens with confusion;  
I the dark prison: I the mournful veil  
that conceals the formless nothing  
and covers its stuff with its wings.<sup>37</sup>

The presumed later version begins with the four elements, Earth, Air, Water, and Fire, emerging from four spheres, quarreling over precedence and authority. Each rides an appropriate steed: lion, eagle, dolphin, salamander. As Fire points out, the four constitute "a globular and confused mass that is called Caos in the language of poetry, and by the prophets Nada [Nothing]."<sup>38</sup> They are only brought to order by Light and the Word in the earlier version and by Power, Wisdom, and Love (the Trinity, speaking as One) in the later version.

The lesson that Segismundo learns on finding himself back in his prison concerns the real world, that is, the fallen world into which we are born, the world of action and experience. The imagery at his initial emergence in the valley of his confinement suggested birth itself, just as the imagery of chains and animal skins suggested the condition of original sin. Returned to his prison after his brief stay in the light—like an accelerated journey between womb and sepulcher—he wakes believing he has dreamed his brief life in the palace (and he has indeed been dreaming it the moment before). But then he has no assurance that his present state is not also dreaming and that—as he concludes in the most famous passage of the play—"even dreams are dreams." He ultimately escapes this dizzying subjective abyss, this labyrinth of infinite recession, by postulating—later, when back in the world of action and tempted to give rein to his passions—a true reality elsewhere. "Who for human vainglory," he asks—awake to its delusive ephemerality—"would lose a divine glory?" (3.2969–2971). But even before Calderón lets this reference to a higher reality (a meaningful order) surface, he translates the metaphysics of uncertainty into an ethics based upon bringing to one's actions a consciousness of the illusory nature of the seeming reality and its attractions. When he is next asked to enter the dream of the outside world, he agrees with open eyes: "Since life is so short, let us dream, my soul, dream again; but with attention and awareness, that we shall have to wake from pleasure



at the last" (3.2360–2363).

In the third act, Segismundo is summoned from his prison by a revolutionary mob that has been roused by the threat of foreign rule and has learned of the existence of a native heir. Once more Basilio's prudent anticipations have had unforeseen consequences in a world whose complexities elude unaided reason. The civil disorder is rendered in apocalyptic images and marked by episodes and emblems of a world turned upside down. Segismundo leads an army while dressed in animal skins. Rosaura, who first appeared in man's dress and then in woman's when at the court, now appears, self-described, as "a monster of both species, in women's skirts and bearing men's arms." Her horse, as described by her servant, Clarín, mirrors her state of mind and recalls and burlesques the "hipogrifo violento" of the opening. Clarín, a gracioso figure, loses his life in seeking to save it, a parody of Basilio's attempts to forestall events while actually helping bring them about. The supreme inversion however, is the fulfillment of the prophecy where the defeated Basilio, father and king, does indeed fall at the feet of his victorious son and offer his neck and white hairs as a carpet. But here is where Calderón's embrace of carnivalesque extremity in registering disorder pays off, in a vision that displaces unaided reason's dream of order with a paradoxical order that incorporates and transcends reason. The sentence of the heavens has been carried out, Segismundo declares, in "this spectacle, this wonder, this horror, this prodigy," despite all attempts to avoid it. Now, he asks, "can I, who am the lesser in age, in valor, in science, overcome it?" (3.14.3228–3241). By raising up his father and in turn falling at his feet, Segismundo accomplishes the paradoxical feat of both fulfilling the sentence of the law and evading it, in an analogue of Christian redemption. The old law gives way to the new, the age of the Father to the age of the Son (or of the Father united to the Son), and—in a fallen world where stability and security are illusory—the authority of "science" and reason give way to the authority of grace and the enlightened and tempered will.

There is a politics to the chaos unleashed in the kingdom, not least by Basilio's radical intervention in suppressing the legitimate heir. A popular revolution that overthrows a legitimate reigning monarch, however, enters upon dangerous ground. That Segismundo ultimately repudiates and incarcerates the leadership of the revolution that brought him to the throne is thus hailed in the play as evidence of his new prudence and wisdom. Behind the politics, however, lies a metaphysics. In the Conceptist faith and aesthetic that Calderón's drama seems to serve, chaos lies in the gap between human reason and experience of the world, undermining the autonomy and security of both. Sharing the insubstantiality of the dream world and the temporary nature of the carnival world, secular reality becomes a labyrinth for the mind seeking a thread, haunted by monsters, terminating in impasse and dissolution. But as the dream of order is brushed aside and the chaos bursts to the surface, there comes the moment of insight and transcendence, of dual awareness, and inversion and monstrosity give way to divine paradox, offering an escape. The law, as read in the tablets of the stars, is fulfilled, and the law is circumvented, as God's justice unites with God's mercy, whereby the human will is freed to choose again and given the light and grace to do so.

## LORDS OF MISRULE

The carnivalesque strategies enlisted in imagining chaos were also the common coin of ironic satire, satire often directed at social practices, sometimes at social norms, but for the most part limited and corrective rather than universal and subversive. Yet it is such broader challenges that hold most interest for us, in works that set out to project a totalizing vision of chaos either as an alternative to what is or as its unmasking. Produced in the stressful passage through the seventeenth to the eighteenth centuries in England, *King Lear* is such a work. So is *Paradise Lost*; so is Pope's *Dunciad*. They fall into a descending lineal succession in their own right, from the imagined chaos of a failed theodicy, to that of a failed polity, to that of a failed poetics. The manifold character of the representation of chaos in *King Lear* will surface for acknowledgment in a final look backward. Here, the failed polity that specially marks *Paradise Lost* will be sought in its projection of chaos as a pernicious inverted form of a redemptive political order, with historical analogues. The *Dunciad*, conscious of Milton, locates its chaos in the leveling proliferation of the debased currency of the print revolution, resulting in a nightmare of uniform and universal insipidity.

In *Paradise Lost*, inversion as a strategy for representing chaos takes on a coloring and complexity that can be likened to the action of parody. If in the poem the Fall itself entails a disruptive leveling, its relatively passive subjects are undone by an agent whose goal is not mere leveling but rather the erection, at once imitative and perverse, of an elaborately hierarchical structure. Satan is engaged not simply in rebellious mischief but in countercreation. His attempted realization of all that his agency implies, producing warfare and subversion, depends on a model, on the structures that constitute order. It is that mimetic constraint which makes his revolution parodic.

As a mode of imitation, parody usually implies an element of facetious burlesque. But parody is serious in Milton, answerable to its production of serious consequences. Nevertheless, that seriousness is qualified. In pursuing the path of imitation and inversion, Satan invests his energies in reversing the irreversible. This gives to his great enterprise a whiff of tragic grandeur but also one of foredoomed haplessness. His countercreation is imbued with an irreducible contingency, a paradoxical and theatrical fictivity that qualifies the high seriousness and lends it a satiric edge. Satan assumes the trappings of deity. Like the carnival kings, he presides over a topsy-turvydom, a stagy parody of the original, a revolution that is only an inversion; like the carnival kings, he can only be king for a day.

Milton, a republican in an age when kingship was the norm, was also the leading apologist of the revolution that dismantled the monarchy, executed the king, and installed a commonwealth that all too soon gave way to Cromwell's protectorate and ultimately to a restored monarchy. On the very eve of that concluding catastrophe, Milton wrote to defend the revolution and its liberties and to ward off the reestablishment of kingship, adding considerably to his own peril. He was already deep into the composition of *Paradise Lost*, and the reconciliation of Milton's revolutionary and republican politics with his epic of damnable and catastrophic rebellion has preoccupied numbers of his ablest readers ever since. Some have found in Milton's Satan an unacknowledged Promethean hero or, more cautiously, have shown Milton systematically subverting the putative absolute monarchy of

God. Others have demonstrated his orthodoxy with respect to hierarchical structure—as in heaven, and the family—with no good coming from forgetting one's place, or have argued the heroic and sentimental attractions of Prometheanism as a homiletic trap for the unwary reader. The former, progressive readings find support in Milton's political life but have to find their way around his declared intentions and many passages in the text. The latter, conservative readings find support in Milton's moral theology but are obliged to postulate a disjunction between the politics of eternity and those of the already fallen world. The naive questions remain, like a nagging conscience: notably, how to deal with republican Milton's portrayal of revolution and rebellion against the most absolute monarch of all?

In the 1970s, in the wake of yet another generation's disappointed expectations for progressive transformation, Christopher Hill wrote at length on the late great poems as Milton's way of coming to terms with a failed revolution. He treats *Paradise Lost* not as Aesopian allegory, reaffirming or rejecting the politics of the past, but as a working out of the realities of loss and the possibilities of hope.<sup>39</sup> As an approach to some of the feeling that charges *Paradise Lost*, Hill's book is eloquent, and it demonstrates the consistency between Milton's politics and his poem without compromising either. In his reading, Milton's poem remains an apologia, as announced, for the ways of God to Man, and that includes recent history. To the naive question, there is no wholly satisfying naive—that is, ahistorical—answer, but within the framework of history, the issue lends itself to the fundamental rhetorical maneuver of the poem: that is to say, a transposition of terms within the antinomy of order and chaos. Revolutions are fought in the name of incompatible definitions of legitimacy, and Charles died because, having waged a war in defense of the God-given prerogatives of the monarchy, the king could be defined by his opponents as a rebel. By representing rebellion as a parodic arrogation of authority and legitimacy, by defining true chaos as a meretricious parody of order, Milton claims legitimacy and true order for his sect.

*Paradise Lost* is a poem saturated with imagined chaos, including its direct representation as a state of the uncreated universe. This primal chaos—a kingdom of sorts—functions as only the simplest form of a condition whose presence in the created universe requires a more extended representation. In the poem, Milton's literal Chaos serves as an ambient reference for the social and political chaos of the falling and fallen world. At the heart of Milton's strategy lies parodic inversion, but as in other instances, Milton is obliged to admit on the scene some of the leveling effects of disorder implicit in the carnival character of a world turned upside down.

Primal Chaos, that material regime of the universe prior to cosmos, appears in *Paradise Lost* both as a place that can be experienced and described and as a personification, one of a cluster of figures embodying aspects and associations appropriate to the locale. The reader's encounter with Chaos under both aspects comes at the end of book 2, after the raising of Hell as a formed architectural and political reality. The first characterization of Chaos comes during "the great consult" in Hell, in Satan's references to the "dark unbottomed infinite abyss," the "palpable obscure," the "vast abrupt," the "void profound of unessential night" that lies beyond the gates, a characterization whose context of manipulative rhetoric allows the reader to defer credence. But Satan's characterization is

then reinforced by the narrator's when Satan leaves Hell on his journey of exploration and subversion. And in that characterization, qualified only by the limitations of language, and in subsequent allusions, most in the context of accounts of Creation, the terms of Satan's initial references recur, including the nominalized adjectives with kinetic effect and the vocabulary of negative description. "Vast," carrying the force of "waste," as well as that of size, and "abyss," carrying the etymological force of "bottomless," are the commonest terms, along with such phrases as "the void and formless infinite" (echoing Genesis 1:2), "the nethermost abyss," "the wasteful deep," "the main abyss / Wide interrupt," "the unapparent deep," the "vast immeasurable abyss," "the vast profundity obscure," "the waste / Wide anarchy of chaos damp and dark," "the unreal, vast, unbounded deep / Of horrible confusion," "the untractable abyss." In addition to Genesis, Ovid, Hesiod, and Plato and his later interpreters would seem to have furnished both conceptual aspects and imagery in Milton's representation. All comes together in Satan's first sight of Chaos from the threshold of Hell:

...a dark

Illimitable Ocean without bound,  
 Without dimension, where length, breadth, and highth,  
 And time and place are lost; where eldest Night  
 And Chaos, Ancestors of Nature, hold  
 Eternal Anarchy, amidst the noise  
 Of endless wars, and by confusion stand.  
 For hot, cold, moist, and dry, four Champions fierce  
 Strive here for Maistry, and to Battle bring  
 Their embryon Atoms...

(2.891–900)

Complementing Genesis, Chaos as the absent geometry of being here bespeaks Plato and the Platonists, Chaos and Night genealogically placed and personified recalls Hesiod, and Chaos as the war of the embryonic elements or their associated natures, and as a dark and boggy compound of land, sea, and air, where Satan "nigh founder'd," treading "the crude consistence, half on foot, / Half flying," elaborately echoes Ovid.<sup>40</sup>

As important as the imagery of war itself—that elemental strife whose most vivid poetic rendering was in Lucretius—is that of noise. On the edge of Chaos, Satan's ear is immediately "peal'd / With noises loud and ruinous" (2.920–921), and he is guided to the court of Chaos by the climax of "a universal hubbub wild / Of stunning sounds and voices all confus'd" (2.951–952). In the angel Raphael's later retrospective account of the Creation in book 7, the Word goes forth not just as Logos but as a word that cancels noise. Creation begins not with Fiat lux but with a preliminary "Silence."

Silence, ye troubl'd waves, and thou Deep, peace,  
 Said then the Omnific Word, your discord end.  
 And, we are told, "Chaos heard his voice."

(7.216–221)

Appropriately, much of the war in heaven is rendered in sound: as a clamor previously unheard; as arms whose "clashing brayed / Horrible discord"; as "outrageous noise," the

belching and farting of the infernal artillery; as the “whirl-wind sound,” like that of torrents and armies, of the divine chariot; as the “unsufferable noise” of the rout through “confounded chaos” (6.208–212, 586–587, 749, 830, 867–871). Hell is full of cacophonies, laments, explosive hissing, as well as oratory, and there is much justice in posterity’s applications of the name of Satan’s infernal city: Pandæmonium. After the fall, the disturbed earth becomes a place of noise and discord (10.695–708). Noise, finally, the noise that reaches its highest pitch in the poem as identifying the heart of Chaos, enters the political world of Man. It marks the one clear allusion to the Restoration, and it further marks Milton’s representation of the “type” of earthly kingship as an offence to God masked in legitimacy. In the first, it appears as “the barbarous dissonance / Of Bacchus and his Revellers” who dismembered Orpheus, drowning the poet’s voice and music with their “savage clamor” (7.32–37). In the second, it results from Nimrod’s hubristic folly in erecting the Tower of Babel. In his conventional rendering of “Babel” as “Confusion,” and in dwelling on the “jangling noise of words unknown,” the “hideous gabble,” the “hubbub strange,” and the din (12.55–61), Milton ties Nimrod and his royal avatars—like Hell itself, Satan’s rebellion, and the Fall—to the aboriginal Chaos.

Investigations of Milton’s Chaos have been concerned with its primary sources, though his effort is eclectic and syncretic, and with its place in the moral spectrum. There is a persuasive argument for the neutrality of the material Chaos, and even for its incipient virtue as the embryonic ground of a monistic universe. Milton’s God himself identifies its limitlessness with his own infinite being. But there is a better argument for its evil disposition and for its moral identification with the uncreating, retrograde principle that is left free to contest the perfection of the evolving universe, an argument based less on Milton’s cosmology and theology than on the affective coloring in his representations of the chaotic. In its unstructured boundlessness, its indiscriminate mixing, its confusion and indeterminacy, chaos in Milton is felt as profoundly unclean, allied to the monstrosity of Sin and Death as well as to the transgressive, degenerate Satan from whom they emanate.<sup>41</sup>

Sin and Death personified stand with Satan on the threshold between Hell and Chaos, Sin a monstrous medley of woman and serpent surrounded by ceaseless noise and confusion, the “hideous Peal” of hellhounds “hourly conceiv’d / And hourly born” from her womb (2.650–659, 795–802). Death, neither shadow nor substance, a shape “that shape had none / Distinguishable,” suggests an even more elementary and abstract form of chaos, linked to primal darkness and formlessness, a parody perhaps of primal substance or hyle (2.666–670). Between them they present positive and negative manifestations of chaos. The personified form of Chaos appears, enthroned and pavilioned with his consort, ancient Night, in company with personifications of chaotic agents and attributes (e.g., Rumor, Chance, Confusion, Discord) or evocations of a tenebrous classical underworld (Orcus, Ades, Demogorgon) (2.959–970). With personification, Milton enlists the available stylistic resources of the evolved epic to double the representation. The personification of Chaos and his court also responds to the bias toward pictorialism and visuality in prevailing poetic theory and to the difficulty in directly imagining the primal chaos, if imagining is understood as visualizing. (The kinesthetic—as in Satan’s limping and struggling progress through Chaos—and the conceptual are strong in Milton’s descriptive accounts, bracketing as it



were the narrowly visualizable.) Writers on Milton and the visual arts note that the subject of Satan's encounter with Chaos, even as personified, is "an extremely rare one in Milton iconography," while "the Chaos which separates Hell from the Universe in *Paradise Lost* is essentially unpaintable."<sup>42</sup>

But there is more than a half-hearted concession to pictorialism in Milton's embodiment of Chaos as a king and his court. Despite his "falt'ring speech and visage incompos'd" (2.989), Chaos is not, as he might well be, a Proteus figure, amorphous and indeterminate, like Death. Rather, he is a feeble, self-pitying old man whose rule depends on manipulation, injustice, and strife, an umpire whose judging "more imbroils the fray / By which he Reigns" (2.907–909). Impotent himself, he is willing to abet Satan in furthering confusion, for "Havoc and spoil and ruin are my gain" (2.1009). In the deep, Milton says, Chaos and eldest Night "hold eternal Anarchy," and Chaos is denominated "the Anarch old." The language here plays off the absent terms "monarchy" and "monarch," anticipating the radical inversion of referents in Shelley's Milton-influenced "Masque of Anarchy." But what is also implicit in Milton's portrait is the deferred hope of a truer Restoration, one consequent upon the apprehension of the true name and nature of monarchy as a system of earthly rule. Indeed, Milton is only generalizing a scriptural example. As the angel Michael will tell Adam, Nimrod, the prototype of earthly kings, not content

With fair equality, fraternal state,  
Will arrogate Dominion undeserv'd  
Over his brethren, and quite dispossess  
Concord and law of Nature from the Earth;

.....  
A mighty Hunter thence he shall be styl'd  
Before the Lord, as in despite of Heav'n,  
Or from Heav'n claiming second Sovranty:  
And from Rebellion shall derive his name,  
Though of Rebellion others he accuse.<sup>43</sup>

(12.25–37)

The inversion with respect to what constitutes rebellion is most pointedly addressed in the episode of Abdiel, who breaks ranks in the midst of Satan's immense legions, a lonely rebel voice, but whose truer perspective will have its heavenly vindication.

The great inverter, Lord of Misrule, is of course Satan, and Satan is the spring, true architect, and presiding autocrat of a system and a structure of parodic inversion pervading the whole epic. When we meet him in the opening episodes of the poem, though he has by no means given up his challenge to the tyranny of heaven, he turns to the building of an alternative kingdom, starting with its architecture, a kingdom that is a perverse echo of that from which he has been exiled.<sup>44</sup> Indeed, the raising of Pandæmonium, the organization of Hell, the climactic assembly of the hosts before the throne, imitate not simply the heavenly imperium but the creation of the cosmos itself. But the Creation, like the heavenly throne and assemblage, and even Lucifer's counterassembly while still in heaven, are yet to come in the poem, in a series of retrospective narrations. The placement has a marked effect on the tone of the early books and on how the reader is likely to respond, for however familiar were the six days of Creation, the heavenly chorus, or the triune Godhead, the matching

has to proceed backward. In Milton's poem, in other words, the parody regularly precedes the original. The Satanic enterprise is (to invent a term) protoparodic, and the effect is to give weight and seriousness to language and actions that otherwise would suffer by an immediate comparison and from the reductiveness of *déjà vu*. To encounter the parody before the original, however, would not run counter to a model of human experience in the seventeenth century, wherein men and women believed themselves obliged to deal with the distorted shadows of a true reality whose secular enactment was yet to come.

Satan's parody is everywhere mimetic. The parodic quality inheres in the failure to achieve a true mimesis, by virtue of defective or inferior materials, for example, or through an unwarranted excess. The imitation is often presented as conscious design, as in "the pomp Supreme, / And God-like imitated State" of Satan in Hell (2.510–511), its capitol "Built like a Temple" but mingling, monstrously, precious and infernal materials, naphtha and fretted gold. Parody inheres in the externality of mere imitation. When Satan, still in heaven, appears in his sun-bright chariot enclosed with flaming cherubim, "Idol of Majesty Divine," Abdiel complains at the persistence of "such resemblance of the Highest" where there is no longer any inner correspondence (6.99–102, 113–114).

The parodic relationship can simply seem to arise, however, as inherent in the nature of a chaotic, anticosmic regime—or in its vivid imagining. So, the Athena-like birth of Sin from Satan's head, and the incestuous union of Satan and Sin ("Thyself in me thy perfect image seeing," in Sin's retelling), engendering Death, who immediately compounds the incest, allegorizes a proverbial causal chain but also offers a grotesque parody of the Holy Trinity, complete with emanation of the ghostly third from the first two persons. The parody concludes with Sin's vision of herself in the newly created world with Satan, sitting in triumph "At thy right hand voluptuous, as beseems / Thy daughter and thy darling, without end" (2.869–870). A whole grid of such schematic analogues (e.g., between the gates of Hell, Heaven, and Paradise; between Messiah's incarnation as man and Satan's as the Serpent) creates a sense of the inescapable dependence of imagined alternatives to the divine order on its original architect and architecture (as well as an ironic limitation on the liberty that chooses to reject that order). It also creates a powerful sense of the relativity of abstract order to an informing moral dimension. That the unholy family of Satan, Sin, and Death, a grotesque emblem of chaos, is configured like the Trinity points that way. What more striking demonstration than when the supreme figure of order empowered, able even to transcend the divide between the one and the many, morphs parodically into incest, confusion, monstrosity, and noise?

Inversion and reversal, implicit or explicit, dominate most of these parodic figurations, even those shaped not by Satan but by God. "Nature" in Hell, for example, is characterized as:

A Universe of death, which God by curse  
Created evil, for evil only good,  
Where all life dies, death lives, and Nature breeds  
Perverse, all monstrous, all prodigious things,  
Abominable, inutterable, and worse  
Than Fables yet have feign'd, or fear conceiv'd...

In Hell, Satan argues that farthest from God is best (1.247). He also argues for the unrivaled stability of his infernal monarchy, as a hierarchy in which the greatest is least enviable, condemned “to greatest share / Of endless pain” (2.24–35). On the other hand, the inversion of the order of heaven, which (as an expression of its supreme being) has no upward limit of majesty and bliss, produces a structure that seems to have no bottom. As Satan observes in his great soliloquy, where he sees furthest into his own condition,

While they adore me on the Throne of Hell,  
With Diadem and Sceptre high advanc'd  
The lower still I fall, only Supreme  
In misery...

(4.89–92)

In understanding Hell subjectively, he perceives an infinite recession of hells, where, “in the lowest deep a lower deep / Still threat’ning to devour me opens wide” (4.76–77). It is in this soliloquy that he pronounces the ultimate carnivalesque inversion: “Evil be thou my Good” (4.110), a declaration made on the newly created earth, in prospect of Eden. Struck by the earth’s beauties and delights but subject to “the hateful siege of contraries,” he finds “the more I see / Pleasures about me, so much the more I feel / Torment within me...all good to me becomes / Bane” (9.119–123). The consequence is that “only in destroying I find ease.”

Yet Satan’s chief successes are not those of actual uncreation. Rather, they are in the construction or inauguration of a fallen order, in Hell and Earth, where the tilting of Earth’s axis, the succession of the seasons, the chain of predation, all have their systematic aspects. The construction of the bridge over Chaos by Satan’s emanations, Sin and Death, is here emblematic of such countercreation. Along with Satan’s success in Eden, “this glorious Work” has made, in his words, “Hell and this world, one Realm, one Continent / Of easy thorough-fare” (10.391–393). Put differently, they have made an order that in the short term seems to serve the principle of positive evil and a disorder that carries, into a Creation informed with positive Good, the visible stigmata of a choice against the Good.

Here too, the action of Sin and Death, flying into “the waste / Wide Anarchy of Chaos damp and dark,” is presented as parodic inversion, parodic of the cosmic creation, which in this case has already had full exposition in the poem. “Hovering upon the Waters” like the spirit of God in Genesis, they drive together what they find, “Solid or slimy,” and this “aggregated Soil” Death smites with his “Mace petrific, cold and dry” (10.282–297). Death achieves fixity and order by binding the raging turbulence “with Gorgonian rigor not to move,” in blatant contrast to the Spirit of God who, “on the wat’ry calm / His brooding wings...outspread, / And vital virtue infus’d, and vital warmth / Throughout the fluid Mass.” All the terms—warmth, vitality, fluidity—are reversed in the cold, dry, petrified countercreation. The materials are the very ones the earlier builder had rejected: those he had “downward purged / The black tartareous cold Infernal dregs / Adverse to life” (7.234–239). A prodigious feat of cosmic architecture, parodic of the divine creation, Milton’s bridge between Hell and the world is symbolic of the restructuring of the conditions of moral life. It is also a notable instance of the violent yoking of disparates, of chaotic monstrosity.

As we have seen, carnival inversions, however rooted in hierarchical ordering, are not to

be insulated from leveling effects. Leveling arguments find their way into Satan's obfuscating libertarian and republican rhetoric and his exchanges (as with Abdiel) about service and servility (5.790–802, 6.164–181). Some of the consequences of the Fall are leveling effects—as in Adam's loss of preeminence in relation to his sons, the indiscriminate corruption of conquerors and conquered, and the equivalence of peace and war, where freedom is lost. But Milton, though not a leveler, can even project with equanimity, at the end of history, the withering away of the divine monarchy (3.339–341). And monstrous mingling and illegitimate usurpation are the commoner content of Milton's nightmare, as opposed to "fair equality, fraternal state" (12.26). Inversion, therefore, parodic of true order, cosmic, social, and moral, dominates his vision of chaos. But inversion—carnival inversion—offers itself as reversible. If the current order—political and otherwise—is defined as carnival order, then its hours must be numbered, with purgation and renewal to come. The overarching action of *Paradise Lost* is complete not with the Fall of Satan or the Fall of Man but in a further, final inversion at the end of the historical process, when Creation is purged of its carnival parodies and the serpentine complexity, the retrograde inversion that appeared as an eruption of Chaos, is annulled and incorporated in an overwhelming incremental good:

O goodness infinite, goodness immense!  
That all this good of evil shall produce,  
And evil turn to good; more wonderful  
Than that which by creation first brought forth  
Light out of darkness!

(12.469–473)

## PARODY REFRAM'D

Though Pope's *Dunciad* makes free with the whole tradition of the classical epic—whose Homeric monuments Pope had recently finished translating—the poem has a particular relation with Milton's *Paradise Lost*. Aubrey Williams elegantly argued the case that in *The Dunciad* Milton's devils are revived, in Augustan London, as dunces, where "they prosper so well that they carry to conclusion the work of destruction introduced by Satan," that is, the restoration of chaos. The poem, full of reference to the infernal side of *Paradise Lost*, erects a visionary "Panmoronium that we cannot contemplate to the exclusion of its great original." The dunces, Williams notes, "turn creation upside down." Pope constantly feeds into the poem the imagery of chaos—in poetry, in politics, in the theater. "But most especially it is the imagery of Milton's Chaos."<sup>45</sup>

Formally and stylistically, *The Dunciad* belongs to the genre of the mock epic, where high style is applied to low matter. In sorting out the comic and satiric art of an age that enjoyed a firm sense of social and stylistic decorum, it is helpful to distinguish between "mock epic" and "burlesque." In the one, trivial people (beggars, lounge lizards, tradesmen) behave like gods and heroes; in the other, gods and heroes behave like trivial people. In the one, the familiar is ludicrously elevated and estranged; in the other, the elevated and strange are profanely reduced and familiarized.

Though much of *The Dunciad*'s scale and power come through its associations with the serious parodic strategies of *Paradise Lost*, the internal action of the poem is nothing like that of Milton's poem, whose catastrophe leads to a final redemptive inversion realizing the project of evil turned to good. Despite its subtextual reminders of a theocentric orthodoxy, Pope's poem offers no prospect beyond its final abysmal vision, whose premise is extrapolation along the track of present conditions to a terminal undoing of all of creation. As Williams notes, when "the dunces turn creation upside down, the universe becomes egocentric rather than theocentric" (136n7). Carnival inversion here produces carnival leveling, but without the positive aspects that intrigued some believers (like Milton) in Christian liberty.

Present conditions are represented in the poem as a world between two chaoses (like that between creation and apocalypse), accelerating with appalling momentum on the downward slope. The first chaos, like the last, is reframed in terms of culture—"civil society" to Pope—and its index is the literate ordering of thought in language. Hard upon the invocation and his declaration of a heroic subject, Pope begins, "In eldest time, ere mortals writ or read," and he goes on to characterize that primal state as the universal empire of Dulness, "Daughter of Chaos and eternal Night," who then "rul'd, in native Anarchy, the mind" (1.9–17).<sup>46</sup> It is an empire that Dulness is forever bent on restoring, and as Pope observes in a note, "This Restoration makes the Completion of the Poem. Vide Book IV."

It is the current state of the world, however, that furnishes the chief matter of the poem, as harboring the disruptive energies whose ultimate triumph it prophetically foresees. In another note, parodic but functional, Pope points out that Dulness is not to be understood as "mere Stupidity" but rather as "a ruling principle not inert, but turning topsy-turvy the Understanding, and inducing an Anarchy or confused State of Mind" (1.15n). The principle acts in society and the arts, most particularly in the realm of the written word, reducing it to the raw material of an industry. The result is an anarchic mingling, social and aesthetic, dissolving all those distinctions of taste, cultivation, class, genre, and sensibility whose divisions and differences harmonize into a stable cosmos, into meaning and indeed beauty. There is a history of rise and decay, leading to the present state, anatomized in *The Dunciad*, but the ahistorical aesthetic and cultural ideal that stands as its implicit alternative had been memorably articulated in Pope's youthful poem, "Windsor-Forest," where "hills and vales, the woodland and the plain...earth and water seem to strive again,"

Not Chaos-like together crush'd and bruis'd,  
But, as the world, harmoniously confus'd:  
Where order in variety we see,  
And where, tho' all things differ, all agree.

(ll. 11–16)

No such concordia discors but rather a discordant mingling is the prevailing condition Pope pillories in his epic satire. To start, he invokes "The Smithfield Muses," those of Bartholomew Fair and its tinsel entertainments, "formerly agreeable only to the taste of the Rabble," but now brought to the ear of kings "to be the reigning pleasures of the Court and Town" (1.2 and note).<sup>47</sup> This indiscriminate inclusiveness is the hallmark of the actor-poet



Colley Cibber, worthy of elevation by the Goddess not only because his prose and verse are much the same but because his absurdity delights both “Dukes and Butchers,” wit and fool. In a first survey, the Goddess, from her Cave of Poverty and Poetry, “beholds the Chaos dark and deep, / Where nameless Somethings in their causes sleep,” a place full of “motley images...Figures ill pair’d, and Similes unlike,” where “Tragedy and Comedy embrace” and “Farce and Epic get a jumbled race,” where time stands still and geography unhinges (1.53–75). This “wild creation” is in fact an anticreation, its “momentary monsters” the chimeras of an anticosmos. Dulness here, “tinsell’d o’er in robes of varying hues,” gilding the momentary monsters “with her own fools-colours” (1.81–84), is none other than Ripa’s iconologic Confusion, “A young woman dressed confusedly in divers colors” to signify her vain and disordinate actions, the inertial agent in the slide to chaos (fig. 3.6).

Images of indiscriminate mingling and hierarchical confusion prevail—in the noise-making contests that are among the heroic games celebrating the accession of Cibber to the throne of Dulness (the “chatt’ring, grinning, mouthing, jabb’ring” that fuse “in one loud din” [2.235ff.]), in the vast crowd that comes to celebrate the occasion (“From drawing-rooms, from colleges, from garrets, / On horse, on foot, in hacks, and gilded chariots” [2.19–24]), in the mushrooming works of Dulness (with “Prose swell’d to verse, verse loit’ring into prose” [2.274–275]), and in the marketplace where booksellers issue blatant hackwork as that of distinguished writers (2.131–140). In the prophetic dream vision that constitutes the third and once final book, Cibber’s Virgilian, or Sibylline, guide (the late City Poet, Elkanah Settle) concludes with a chaotic miscellany, drawn from the playhouses, of scenes that please those “Not touch’d by Nature, and not reach’d by Art,” where

Gorgons hiss, and Dragons glare,  
And ten-horn’d fiends and Giants rush to war.  
Hell rises, Heav’n descends, and dance on Earth:  
Gods, imps, and monsters, music, rage, and mirth,  
A fire, a jig, a battle, and a ball,  
’Till one wide conflagration swallows all.

(3.235–240)

Cibber, whose dream vision visits him when asleep in the Goddess’s lap, is very much a carnival king, plucked from the depths of misery and enthroned above his peers and predecessors:

High on a gorgeous seat, that far out-shone  
Henley’s gilt tub, or Fleckno’s Irish throne...  
Great Cibber sate...<sup>48</sup>

(2.1–5)

Cibber is first found, however, in lowly estate, surrounded by the debris of aborted composition, wherein he replicates Satan’s journey through Chaos:

Sinking from thought to thought, a vast profound!  
Plung’d for his sense, but found no bottom there;  
Yet wrote and flounder’d on in mere despair.

(1.118–120)

He is worthy of his elevation not only because of his indiscriminating habit and leveling appeal but because, as he later learns, all the chaotic absurdity foretold in his dream vision “is in thee! Look and find / Each monster meets his likeness in thy mind” (3.251–252). Complementing the Dantesque parallels and the reminder of Milton’s episodes of prophetic revelation, the echoes of *Paradise Lost* here follow its inward turn. Satan’s anticocosmos was equally within, and its monsters equally tied to the engenderings of his mind.

The movement to a terminal negation was marked in the earlier three-book *Dunciad*, and it is magnified exponentially in the four-book final poem. It carries an affective charge that reaches beyond the local targets of its satire and escapes the self-sanitizing safety features of the mock-epic mode. That charge is tied, I believe, to a revulsion from the corruption perceived as inherent in all things, the inevitable decay that is both the prologue and the consequence of mortality. Pope in his invalidism doubtless had special reason for such an awareness. He had precedent for its articulation in the writings of his friend Swift and of course in the vast classical repertory of scatological satiric abuse. Aging, the loss of friends, and accumulated experience often give the sense of bad things getting worse and hopeful things going to the devil. In any event, *The Dunciad* is a poem built upon the pessimism of experience, and it eschews the Miltonic escape into a carnivalized transcendence, except in the exhilarating brilliance of its own achievement.

Satire may be defined as the literary expression of the impulse to hurl excrement at your enemies, latterly in the civil guise of correcting their faults.<sup>49</sup> Exposing the secret corruption of one’s enemies, their folly or wickedness, and besmearing them with the emblems of corruption are not always distinguishable acts. But magically distancing danger and enmity by anointing it with the voidings of one’s own perishable economy may be driven as much by vital exuberance as by hatred and fear, hatred and fear of the enemy within as well as of the enemy without. I have already touched on the elusive link between issues of personal mortality and the imagination of chaos, particularly as concretized in what some have called “the excremental vision.” And I have suggested its role in Pope’s vision of chaos, whose negativity includes a fear of annihilation not simply of consciousness—leaving only an inert, decaying corporality—but of cultural memory, the immortality commonly attributed to the poet and his art.

The cloacal finds its most exuberant expression in the heroic games of book 2. Among its featured events, not only is there the race of the booksellers, with Curll’s unfortunate accident in the morning deposit of one of his own authors and Jove’s intervention from the divine water closet, but a pissing contest (with an authoress and a china jordan as prizes) and—after the obligatory noise contest—diving and swimming events in the Fleet Ditch (an open sewer), suitable for party-political writers and scandal-mongering journalists, with the prize going to “who best can dash thro thick and thin / And who the most in love of dirt excel...Who flings most filth, and wide pollutes around / The stream” (2.276–280). The winner, slow rising “in majesty of Mud” from “the black abyss,” relates his adventures among those “Nut-brown maids,” the Mud-nymphs Lutetia, Nigrina, and Merdamente, who drew him down. In these contests for “best,” best equals worst, and even to be entered in the contest is to be drawn down and besmeared. The last of the games, concluding book 2, links such sport to the movement in the poem toward a more purely negative form of

annihilation. It is an exercise for both critics and authors to see who can stay awake the longest and whose works are “heaviest.” The most soporific modern works are read aloud with predictable effect, the contagion of sleep spreads in circles through the sea of heads, and listener and poet give over until “all was hush’d, as Folly’s self lay dead” (2.418).

What follows, in book 3, is the dream vision of the sleeping hero, where Cibber is offered a Pisgah view of Dulness’s empire, including past, present, and future. It shows a progress in negation, starting “whence the Sun / And orient Science their bright course begun” (3.73–74). Britain, at the furthest edge, appears as a latecomer to learning and light and as an embattled final holdout against Dulness and darkness. But:

...see, my son! the hour is on its way,  
That lifts our Goddess to imperial sway:  
This fav’rite Isle, long sever’d from her reign,  
Dove-like, she gathers to her wings again.

(3.123–126)

What follows is a mustering of the present-day Grub-street armies of Dulness, including modern learning and modern theater, and, for the original conclusion of the poem, the prophetic vision of the final triumph of Dulness in the very near future:

She comes! the Cloud-compelling Pow’r behold!  
With Night Primæval, and with Chaos old.

In the final version of the poem, the restoration of chaos is transferred to the end of the new book 4 and reported not as vision but as present reality, an overtaking event. The local satire of book 4 is directed at modern learning and education, the latter well calculated, says its presiding pedant, to “petrify a Genius to a Dunce” and “bring to one dead level ev’ry mind” (4.264–268). But if book 3 suggested a wandering geography of civilization and decay and even the progressive decay of civilization entire, book 4 affirms the underlying corporeal models even more clearly and indeed discloses the personal root. The Miltonic opening of book 4 prepares for its apocalyptic close by incorporating the consciousness of personal mortality that drives the generalized horror of corruption, dissolution, and annihilation. The poet’s delaying appeal begins:

Yet, yet a moment, one dim Ray of Light  
Indulge, great Chaos and eternal Night!  
Of darkness visible so much be lent  
As half to shew, half veil, the deep Intent.  
Ye Pow’rs! whose Mysteries restor’d I sing,  
To whom Time bears me on his rapid wing,  
Suspend a while your Force inertly strong,  
Then take at once the Poet and the Song.

(4.1–8)

An ambiguously ironic note (whose sentiments are attributed to “Scriblerus,” or Swift) asserts that “in spite of his unusual modesty,” this Poet “shall not travel so fast towards Oblivion” as others who have promised themselves Immortality. But the next note, evidently concocted by Pope and Warburton, identifies the “Force inertly strong” of Chaos and Night

with the “Vis inertiae of Matter,” that is—Newtonianism aside—with the inevitable tendency in all things toward death and dissolution.

Book 4 takes us back to book 1. It again tells over the positive blessings that displaced the primal darkness and represents their present degeneracy. In the sickly season of the year and of the cosmos, Dulness, “Seed of Chaos and of Night,” launches her final putsch. Her reactionary object is to “To blot out Order, and extinguish Light” and, with their dissolution, to prepare for a new birth that parodically recapitulates the pristine world of classical myth, now forged from the debased intellectual coin and commercial spirit of the present:

Of dull and venal the new World to mould,  
And bring Saturnian days of Lead and Gold.

(4.15–16)

In the dual metallic projection, Pope condenses mythological and alchemical schema, incorporating base and noble in a leveling amalgam that cancels difference.

Dulness asserts her universal claims in an iconic epiphany: of a tyranny that holds the personifications of knowledge and art in bondage, exiles Wit and strangles Morality. The Muses especially suffer, in contrast to “the Harlot form” of Opera, who is full of spite toward “the prostrate Nine” and comes singing, “Joy to great Chaos! Let Division reign!” (4.54). It is the monstrous, indiscriminate medley that Pope stresses in Opera, ignoring decorum of genre or mode, “her robe’s discordant pride / In patch-work flutt’ring.” Such reductive confusion returns in the final movement, a rush into the irresistible vacancy of Dulness, framed earlier (with transparently veiled indecency) as a gravitational vortex, where the vast throng of all nations “who feel her inward sway” either “conglobed” like bees around the queen or “gently drawn, and struggling less and less, / Roll in her Vortex, and her pow’r confess” (4.71–84).

Like the poem as a whole, book 4 is a fiction about words and their power of world making and world undoing. The spectral master of the schools declares:

Since Man from beast by Words is known,  
Words are Man’s province, Words we teach alone.

(4.149–150)

The idolatry of words, their reification in scholastic pedantry, their substitution for nature and sense, their solipsistic confinement as the reflexive subject of argument and learning, are mustered here into the forces bent on restoring the ancient right of Dulness in the preliterate world. But the crucial status of the word comes into focus in the last lines of the poem, in the powerful condensation of a single phrase: “thy uncreating word”—a phrase that inverts the divine instrument of making, turning it into the agent of erasure for the structure of difference that constitutes cosmos (that is, beauty) and sustains life in the face of death and decay.

The final apocalypse has begun with a further opening of the abyss, a monumental yawn: “All Nature nods: / What mortal can resist the Yawn of Gods?” (4.605–606). The yawn spreads, from churches to schools to government—“Wide and more wide, it spread

o'er all the realm," to armies and navies, and as the poet once more invokes the Muse,

In vain, in vain—the all-composing Hour  
Resistless falls: the Muse obeys the Pow'r.  
She comes! she comes! the sable Throne behold  
Of Night primæval, and of Chaos old!

(4.627–630)

The end, in one of the great orchestral climaxes of English poetry, enumerates a progressive extinction, cosmic and intellectual, as Fancy's clouds and rainbows decay and die away, Wit's meteor "drops, and in a flash expires," and, like the sickening stars or Argus's closing eyes, Art after Art goes out, and all is Night. Truth is buried, Philosophy shrinks and vanishes, natural antagonists, like beasts in a flood, huddle in the common danger:

Physic of Metaphysic begs defence,  
And Metaphysic calls for aid on Sense!  
See Mystery to Mathematics fly!  
In vain! they gaze, turn giddy, rave and die.  
Religion and Morality follow suit,  
For public Flame, nor private, dares to shine,  
Nor human Spark is left, nor Glimpse divine!

—and in a final leveling extinction, carrying back to the first act of Creation:

Lo! thy dread Empire, CHAOS! is restor'd,  
Light dies before thy uncreating word;  
Thy hand, great Anarch! lets the curtain fall  
And universal Darkness buries All.

## THE WILD GOD

Vico, in his New Science of history, explains that the mythic, embodied form of chaos was later understood by the physical philosophers as "the prime matter of natural things, which, formless itself, is greedy for forms and devours all forms." But the poets then "gave it also the monstrous form of Pan, the wild god who is the divinity of all satyrs inhabiting not the cities but in the forests," a form influenced by forest vagabonds "having the appearance of men but the habits of abominable beasts." Afterward, thanks to his misleading name, Pan became a figure for the All.<sup>50</sup> Such an equivocal lineage—chaos, embodied and personified, understood as nature's undifferentiated substrate, given monstrous imaginative form as "the wild god" when compounded with uncivil animality, and then universalized—found a belated inheritor in one of the iconic apostles of the unnatural, a herald of universal chaos, the philosopher and fantasist, the Marquis de Sade. Unlike his predecessors in the field of carnival chaos (Bruegel, Jonson, Milton, Pope) but like some of their ambitious protagonists, Sade had no interest in containing the chaos he imagined but instead stakes a claim as its author and agent. It is he who would undo Creation.

Sade persistently comes to the fore in attempts to understand the psychology that



produces human monstrosity and that drives transgression of the norms and categories that help structure reality. In one such valiant attempt, using psychoanalytic perspectives and aimed at eliciting the links between creativity and perversion, the analyst Janine Chasseguet-Smirgel looks to Mircea Eliade musing on the Dionysian rites involving cross-dressing. "Their aim," he writes, is "regression to primordial confusion...and their goal is the symbolic restoration of 'chaos,' the state of unity without differentiation that preceded the Creation." "My hypothesis," she adds, "is that perversion represents a similar reconstitution of Chaos, out of which arises a new kind of reality," something she calls "the anal universe."<sup>51</sup> She cancels the commonplace antinomy between the normal and the perverse by arguing for "a 'perverse core' latent within each of us that is capable of being activated under certain circumstances," a disposition rooted in biology, notably the prolonged immaturity of the human animal. The usual view of perversion is as a deviance from whatever is normal and natural, such that it is marked by its otherness. "Perversion" is here made part and parcel of the underlying universal human condition.

If our ordinary social reality is structured by differences between the sexes and generations, erosion of that "double difference" aims, on the one hand, at mixture, that is, at transgressive union, and, on the other, at leveling, that is, regressive annihilation of all difference. Sade offers both aspects in the program of his fantasy world. On the one hand, in the Sodom of his dreams, "All will be higgledy-piggledy, all will wallow, on the flagstones, on the earth, and, like animals, will interchange, will mix, will commit incest, adultery and sodomy."<sup>52</sup> On the other hand, he envisages the breaking down not just of all barriers and differences but even of bodies, in dismemberings and mutilations, destroying reality and "thereby creating a new one, that of the anal universe where all differences are abolished" (3). Chasseguet-Smirgel finds a model for Sade's universe—and inferentially his work and its ambitions—in the digestive tract, an enormous grinding machine rendering nature and breaking it all down. She writes of his Epicurean view of nature as a great cauldron where nothing is lost, where all forms are equal and constantly varying, where, however, the metamorphosis and dissolution of forms, the dissociation of the molecules, "means that all things must revert to chaos, the original chaos that may be identified with excrement" (4). The cloacal imagery that pervades, in monstrous form, the infernal carnivals of Bruegel and Bosch and haunts the fantasies of Satanism and witchcraft, the nightmares of Swift and Pope, here claims a universal analogue and a base in the archaeology of the psyche.

Sade's imaginative world, like that of his Renaissance predecessors, responds to a religious tradition marked by a horror of forbidden mixtures not only in the sexual realm but in diet, agriculture (hybridization of cattle, sowing with mingled seed), and even garment making and to a philosophical tradition calling for clear and distinct ideas in hierarchical order. The upshot of his revolt is an antiworld that depends on hybrid monstrosity, but only to dissolve it in the general dissolution of boundaries and differences. As an antiworld, it often defines itself through parody—as in the Laws of Sodom or as a narrative that normalizes the Misfortunes of Virtue—and in so doing it links itself, if only negatively, to normality and the structuring ideas of the actual world. It seeks a world wholly liberated from limit and constraint—where, as in God, thought and deed are one and where capacity is no limit on performance. It seeks not the inversion of hierarchy, the classic carnival

maneuver, but its abolition in mixture and change, releasing the energy necessary to prevent permanent sedimentation, an adumbration of the notion of permanent revolution. It is also about power and as such perpetrates a perverse world where freedom loses itself in egomania and onanistic futility and where pain inflicted and experienced equals pleasure. But its chaos straddles a divide between alternative value systems and scientific views as well as successive cultural climates. On one side (from which Sade draws his danger), Satanic energies, untamed and perhaps even enhanced by carnival release, can only prove destructive. On the other, as we will see, such raw, uncontained energies, however chaotic, can and will be transformed into something creative and progressive in the dynamic imaginings of the dawning nineteenth century.

## REPRESENTATION

If, at [War's] deadly approach, every blossom of happiness is instantly blasted, every thing that was improving gradually degenerates and dwindles away to nothing, every thing that was firmly supported totters on its foundation, every thing that was formed for long duration comes to a speedy end, and every thing that was sweet by nature is turned into bitterness; if war is so unhallowed, that it becomes the deadliest bane of piety and religion; if there is nothing more calamitous to mortals, and more detestable to heaven, I ask, how in the name of God, can I believe those beings to be rational creatures; how can I believe them to be otherwise than stark mad; who, with such a waste of treasure, with so ardent a zeal, with so great an effort, with so many arts, so much anxiety, and so much danger, endeavour to drive me [Peace] away from them, and purchase endless misery and mischief at a price so high?

—Desiderius Erasmus, *The Complaint of Peace* (1517)

Faced with the challenge of depicting chaos, and not content to evoke it as what it was not or to depend on mere vacancy, innumerability, or inversion, many artists, poets, and thinkers found an apposite resource in the imagery of war. War, and perhaps only war, provides a set of references in human activity that has the scale, reach, intensity, and concreteness to support the notion of a universal disorder. However, as an instrument for the representation of chaos, the trope of war transcends the slant logic of metaphor. That is, implicit in the use of the imagery of war to characterize chaos is an intimation of substantial identity, wherein comprehensive, unmitigated disorder speaks to the true nature of war. Accordingly, language and imagery associated with chaos is, turnabout, habitually conscripted for the representation of war. In the attempt to convey this collective violence between societies, sometimes only the specter of universal chaos can seem adequate to the task of compassing the catastrophic reality.

There are ironies here, as in the fact that hardly any human activity has been so formalized, hierarchalized, and organized as war. The communal need and personal hope to limit and contain death and destruction has fostered ritualized forms of battle in most preindustrial societies known to history and anthropology. In the West, moreover, drill and uniform and all they imply became war's adjuncts, and directed energy, purposefully concentrated and shrewdly applied in concerted action, has long been understood as the guiding principle in what is unabashedly labeled "the art of war."<sup>1</sup> If that were not enough, untold intellectual effort has been expended on the task of eliciting the "laws" of war, both in a scientific sense and in a legal and social sense—the latter, a body of thought, argument, and legislation intended to set limits upon under what circumstances and provocations (*jus ad bellum*) and by what means (*jus in bello*) aggregations of humanity may legitimately slaughter each other.

From Sun Tzu to Machiavelli to Clausewitz to Herman Kahn, war has evoked systematic expositions of the forces and principles whereby it can be waged in a purposeful,

predictable, end-governed manner. From early Greek rules of engagement, to medieval just-war theory, to Hugo Grotius's foundational *De Jure Belli ac Pacis* (1625), to the UN Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (1981), limitation and constraint along with legitimating formalities have been employed to contain the universally felt chaotic impetus of war.<sup>2</sup> One ironist prepared to exploit these countervailing impulses is Bertolt Brecht. In the conversation that opens Brecht's *Mother Courage*—his fierce commentary on war and commercial enterprise in early seventeenth-century Europe—one veteran recruiter offers a view of war as intrinsically ordering, in contrast to the anarchic indiscipline of life lacking its imperatives:

**THE SERGEANT:** It's easy to see these people have gone too long without a war. How can you have morality without a war, I ask you? Peace is a mess [nur Schlamperei], it takes a war to put things in order. In peacetime the human race goes to seed. Man and beast are treated as if of no account. Everybody eats what they like, a big piece of cheese on white bread, with a slice of meat on top of the cheese. Nobody knows how many young men or good horses there are in that town up ahead, they've never been counted. I've been in places where they hadn't had a war in as much as seventy years, the people had no names, they didn't even know who they were. It takes a war before you get decent lists and records; then your boots are done up in bales and your grain in sacks, man and beast are properly counted and marched away, because people realize that without order they can't have a war.<sup>3</sup>

Nevertheless, with the wisdom of experience many eons in the making, mankind generally takes another view of war and its wreckage; hence its utility in evoking unlimited chaos. We can begin, then, with the conscription of the trope of war to represent the aboriginal chaos and its resistance to the cosmic principle. And we can end these chapters with the recruitment of the idea of battle to the final consummation, as Armageddon and apocalypse. For in the extremity of both these first and last things, the representation of war and the imagination of chaos consummate their long partnership.

## CONSCRIPTING WAR

Lucretius and Ovid, whose representations of the primal chaos would haunt both the science and the poetry of subsequent millennia, find the conceptual language they need for chaos in the imagery of war. For the canny Lucretius, whose imaginative program entails distinguishing philosophic explanation from mere imagination or superstition while sustaining a proximity to the truth of experience, the imagery of war enters at one remove. To suggest the chaotic motions of the invisible free atoms in the void, Lucretius calls up the familiar, closely analogous, seemingly random motion of motes in a sunbeam. Lucretius writes, "you will see many minute particles mingling in many ways throughout the void in the light itself of the rays, and as it were in everlasting conflict struggling, fighting, battling in troops without any pause, driven about with frequent meetings and partings" (2.116–120).<sup>4</sup> Lucretius sees such shock and recoil continued beyond the primal state, even where atoms have combined into small aggregates. These bodies not only attack/impel (*laccunt*) other larger bodies but remain subject to the rival tendencies of accretion and decay. "Thus the war of first-beginnings waged from infinity is carried on with doubtful issue: now here, now there the

vital elements gain the mastery, and in like manner are mastered” (2.569–276). The war continues, even, it would seem, intensifies, in the conventional chaotic aggregate that is commonly the first phase in the creation of the organized world. In “a sort of strange storm, all kinds of beginnings gathered together into a mass, while their discord, exciting war amongst them, made a confusion of intervals, courses, connexions, weights, blows, meetings, motions...” (5.436–439). And the war continues, like the motion of the primordia themselves, in the fully organized world. There, in the finite cosmos of constituted entities we inhabit, the contest shall one day end, necessarily, in utter destruction (5.91–96), in contrast to the perpetual war of aggregation and dissolution in the open, infinite universe, where neither tendency can ever have it all its own way. Unlike many of his Greek predecessors, Lucretius seeks to avoid reified abstractions (though not anthropomorphized description). Hence, it is not a principle of “Strife” that will ultimately triumph in our world but rather the long-term inevitability that, in the unending civil war of the elements, an overwhelming imbalance will at some time occur, even as foreshadowed in the stories of Phaeton’s scorching journey and Ducalion’s flood (5.380–415).

Ovid makes things simpler in his vivid synthesis of myth and thought *Metamorphoses*. In the primitive, undifferentiated mass that is his chaos, things in their incipience are at war. “All objects were at odds [*obstabatque aliis aliud*], for within one body cold things strove with hot, and moist with dry, soft things with hard, things having weight with weightless things”—a state of universal conflict schematized as a war of opposites and aptly elaborated in Diepenbeek’s seventeenth-century representation ([fig. 1.1](#)). For cosmos to arise, in a concord of elements, such conflict had to cease. In Ovid’s *Fasti*, however, it is the conflict itself that provides the impetus for the separation of the elements into their appropriate spheres, which results in the organized universe.

Such a police-action approach, separating and even segregating incompatible antagonists, is much to the fore in another tradition. Interpreting Genesis, the Hellenized Philo Judaeus, writing not long after Ovid, explains that following its creation, God separated light from its adversary, darkness,

well knowing their opposite characters, and the enmity existing between their natures. In order, therefore, that they might not war against one another from being continually brought in contact, so that war would prevail instead of peace, God, turning want of order into order, did not only separate light and darkness, but did also place boundaries in the middle of the space between the two, by which he separated the extremities of each.<sup>5</sup>

Yet darkness itself, like the abyss of waters or the dragon of chaos, remains a threat in many such cosmologies as an active warring principle in the created world or as a delayed charge that will explode in a final consuming battle. Most blatantly, in Zoroastrianism, Ormazd, identified with fire and light, deliberately created the world as a battlefield in order to overcome his antagonist, Ahriman, a strategic plan whose far-seeing wisdom has yet to be vindicated. The early modern Huguenot poet Du Bartas, who gives one of the ampler accounts of the brawls of the primal chaos, or “first World”—

Where hot and colde were jarring each with either;  
The blunt with sharpe; the danke against the drie,  
The hard with soft, the base against the high—



further laments the relapsed condition of the fully constituted world, as changed by Adam’s sin: the animals,

Their Harmonie dis-tuned by His jarre  
Yet all againe concent to make Him warre;  
As th’ Elements, and above all, the Earth:  
Three ghastly FURIES: Sickness, Warre, and Dearth.<sup>6</sup>

The turbulent primal chaos in Paradise Lost—or, as its Anarch complains, all that is left of it after Hell, Earth, and the heavens have been subtracted—is where Satan breaks out of his confine: “Into the wild expanse, and through the shock / Of fighting Elements on all sides round / Environ’d” (2.1014–1016). The normal bent of chaos in the poetics of Paradise Lost, however, seems to be to take a shape: to embody and institutionalize itself as Pandæmonium, as Satan’s government, as the Court of Chaos, as the bridge over the abyss, and not least as the War in Heaven. Satan’s rebellion is itself the eruption of the chaotic principle inherent in the freedom to fall. But the three-day battle it occasions dresses itself in the forms and trappings of warfare between the heroes of the classical epic not just in armor and weaponry but in the hosting of the forces, their order of battle, the preliminary rhetoric of the field, the formal patterns of single combat beginning with taunt and reproach. Still, the organization that dominates the preliminaries and marks the onset gives way to an incremental, widening, and intensifying chaos until the whole structure of the universe seems imperiled. The engagement itself is rendered as “dire...noise,” “dismal hiss,” “horrible discord,” braying clash of arms on armor, and general clamor “such as heard in Heav’n till now / Was never”—a chaos of sound (6.207).

The single combat of Satan and Michael is given scale through an apocalyptic analogue. Milton asks his auditors to imagine what it would be like “if Nature’s concord broke,” and “Among the Constellations war were sprung,” and two planets “Of fiercest opposition in mid Sky, / Should combat, and their jarring Spheres confound”(6.311–315). When the rebel host is discomfited, it suffers “deformed rout” and “foul disorder,” with armor strewn, steeds and chariots overturned, while the saints advance “in Cubic Phalanx firm.” When on the second day the Satanic forces bring to bear their newly invented artillery (belching, vomiting, voiding), “whose roar / Embowell’d with outrageous noise the Air,” the saints resort to hurling hills and mountains, which their enemies reciprocate, mingling earth and air, as in the elemental chaos, and producing

Infernal noise; War seem’d a civil Game  
To this uproar; horrid confusion heapt  
Upon confusion rose...

After such escalation, it takes the intervention of the Messiah on the third and final day to prevent the wrack of all, and to send the uprooted hills back to their appointed places, while the hosts of Satan are driven out into “the wasteful Deep.”

Hell heard th’ insufferable noise, Hell saw  
Heav’n ruining from Heav’n...  
.....

confounded Chaos roar'd,  
And felt tenfold confusion in their fall  
Through his wild Anarchy...

(6.867–874)

Satan will of course succeed in introducing a fatal strain of chaos into the new creation, with human help, but the full release of its incipient anarchic energy (foreshadowed in the cosmic register of Michael and Satan's prior collision) will come only with the end of the story, in the Armageddon of the apocalypse.

It is hard to see war as a good in *Paradise Lost*, though Milton makes plain that peace at any price is a sentiment that only the latter-day sons of Belial might stomach. The Father, however, permits the War in Heaven to go forward for his own inscrutable purposes. There are hints of cat and mouse—to add a deluded hope of victory to the punishing torments of the rebel angels—and also hints of a political design, to establish the superiority of the Messiah, held in reserve until the decisive moment, as on altogether another plane even by the norms of titanic warfare. In the long run, of course, the divine strategy is to bring an unimaginably greater good out of evil, including the evil of war. But this justification of the ways of God to Man neither redeems evil itself nor argues that strife has a positive role in the cosmos, or even that it is the necessary complement of order. The original cosmic creation in Milton's universe brought out of chaos a perfectly harmonious world governed by love. To fight against evil in the fallen world is a virtue and even an obligation, but final victory means an end to such chaos and the restoration of unmitigated concord and perfect order.

In withholding a metaphysical accreditation for strife, Milton differs from some of his predecessors and successors, who assign contention and hostility ("repulsion" in some later physical systems) a direct positive role in making or sustaining the universe. Strife is the necessary complement of love in Empedoclean physics, active in the constitution of things through separation; it is in the very nature of the entire living creation in Heracleitean doctrine; it is the necessary means of world making in Marduk's defeat of the chaotic Tiamat and his subsequent architectural deployment of her remains; it is the necessary impetus to social, economic, or political evolution for the social Darwinists and some modern theorists of the state.<sup>7</sup>

There are many excellent reasons for the value so commonly attached to the figure of the great warrior in the memory and practice of human societies, but war itself is a more problematic candidate for valorization. Nevertheless, even outside successful predator societies there is an incentive to make war meaningful. To counter the extremity of the challenge to order, material and social, mental and physical, and neutralize dread, much can be made of those marvels of organization inspired by the mere prospect of war: the mobilizations, logistics, fortifications, dispositions, command structures, bureaucracies, and latterly the focusing and unification of the will and effort of entire peoples. As the recruiter in *Mother Courage* says, "Ohne Ordnung, kein Krieg!"—without order, they can't have a war. So, emblematically, in Robert Fludd's compendious account of both the great and little worlds, the title page of his treatise on the art of war shows the beautiful pentagonal geometry of a fort seen from above, under orderly siege on its lower face.<sup>8</sup> And most

extravagantly, in Sir John Davies's *Orchestra*, an Elizabethan poetic defense and exposition of Dance, he notes that:

After Townes and Kingdomes founded were,  
Between great States arose well-ordered War,  
Wherein most perfect measure doth appeare  
Whether their well-set ranks respected are  
In Quadrant forme or Semicircular:  
Or else the March, when all the troupes aduance  
And to the Drum in gallant order daunce.<sup>9</sup>

It would not be difficult to compose a history of the idea of war as a pillar not just of society and the state but of the moral order. Classical virtue and romantic chivalry would clearly make lavish contribution, but even post-Darwinist thought would add its mite, having managed to dress up war in the garments of an ethical idealism. Such views played a significant role in what is in retrospect the run-up to the Great War of 1914–1918. To note one striking instance, Colonel F. N. Maude, C. B., in a 1907 treatise called *War and the World's Life*, begins his philosophical rationale with one of Clausewitz's most disconcerting dicta: "War is closely analogous to business competition, pushed to its full logical consequences, and unrestrained by the action of any law other than that of expediency." What then follows is essentially the Darwinian formula of the "struggle for existence" transferred to the rivalries of nations. As in the struggle of individuals, where the one best fitted to compete in its environment survives, so also with nations. The difference, Maude argues, is that whereas in the struggle between individuals "fittest" does not mean ethically the "best," in the struggle between nations, whether in peace or war, "the ethical factor"—the capacity for self-sacrifice, which includes duty, honor, and personal integrity—does matter. In terms of what makes a race or a nation great, it dominates all other factors. Convinced by experience "how very narrow was the line dividing international trade competition from actual hostilities," Maude concludes that the wartime virtues,

essentially truth, honour, justice, and self-sacrifice, are as necessary to ultimate success in business competition as they are in War—only the need is not so apparent in the former as in the latter. For that very reason War is an indispensable necessity of human progress, for without its lessons these fundamental principles are apt to be forgotten in the race for wealth.<sup>10</sup>

The argument for trade in earlier generations was that it knit nations together and was an antidote and opposite to war—an argument compromised even at the time by mercantilist beggar-thy-neighbor principles and maritime and trading-company wars.<sup>11</sup> Equating trade and war using the Darwinian paradigm and the Clausewitz analogy made sense of the wars and near-wars in the period of colonial expansion and intensified industrial competition. But as Sun Tzu had observed millennia before, "there never has been a protracted war from which a country has benefited," and those normalizing rationales crediting war not with the disruption but with the enhancement of the biological and economic orders collapsed in the face of the devastating scale, the economic and human cost, and the moral effect of the 1914–1918 catastrophe and faded from view for half a generation. As we shall see, it is in the shadow of protracted war, widely experienced and

sufficiently devastating, that the most uncompromising depictions of war as chaos occur.<sup>12</sup>

Wellington, like Davies—who distills war into measured motion and formation—similarly finds a useful analogy for battle in the dance, though to opposite effect. It is the battle in retrospect, as subject to coherent narration, that his analogy serves. To an enquirer who sought his help in an account of Waterloo, he wrote: “The history of the battle is not unlike the history of a ball! Some individuals may recollect all the little events of which the great result is the battle lost or won; but no individual can recollect the order in which or the exact moment at which, they occurred, which makes all the difference as to their value or importance.”<sup>13</sup> The emphasis on the Eve of Waterloo ball in so many accounts of the battle and in Victorian art (Millais’ *Black Brunswicker* and Thackeray’s *Vanity Fair* are prime instances) can’t help but suggest itself. In Thackeray’s novel, the event resolves in the chaos of panic and flight among the civilian population and the shockingly unexpected denouement in the summary battle account, the arbitrary death of the handsome young officer who ought to be, in the typology of fiction, the hero.

The problem Wellington perceives lies in the conversion of experience into a meaningful form of knowledge, one in which the chain (or cascade) of causation is recoverable and coherent. Without the possibility of such conversion, the experience must remain essentially chaotic. An experiential view, one that takes into account only what the senses are able to perceive and the mind apprehend and retain, it is the foundation of a powerful line of modern representations with a subjective focus.

This vein of representation, of battle narrative as the experience of an incomprehensible chaos, is one of the strains discussed below. It will follow on considerations of war not as climactic event (like D-Day or Waterloo) but as sustained condition. As such, and with war experienced as communal and societal chaos, it demands another form of representation, which it finds, for example, in the cumulative imagery of a number of print series (Callot, Goya, Dix) taking their cue from the graphic and poetic trope commonly labeled “The Miseries of War.” War rendered symbolically, as the expression and agent of chaos, offers yet another strategy of representation, both through personification and in condensed emblematic images. It is with a few of these images that I shall begin.

## EMBLEMATICS

Personification fell out of favor in the rhetoric of poetry and painting between the eighteenth and nineteenth centuries and barely survives in the modern world. But in one holdout area, the realm of the political cartoon, it continues to flourish. It is there especially, and in some closely related poster art, that the hardiest of the classical pagan gods also survives. The standard twentieth-century personification of war was a version of Mars, complete with antique armor, but Mars at his most brutal and brutalized. In earlier imagery Mars, even as god of war, recognizably remained an Olympian. Moreover, neither was he the only figure used to represent allegorically the threat, the onset, or the ethos of war. Nor even where he did represent the martial spirit was that spirit as a matter of course equated with the onset of chaos. For such purposes, other figures were better qualified, such as Ate, or Discord,



with her torch, or one of the Furies, or even the fierce Bellona. Mars, however, having outlived his female rivals and counterparts, would seem to have absorbed their most disintegrative significations. As in the classic cartoons of David Low, the armored giant War projects only destructive force and mindless brutality, with perhaps a glimmer of malicious cunning. In this character he recalls Milton's assimilation of classical Mars to the devouring, brazen Moloch and the mindless Titans of Goya's darkest imaginings. Moreover, like the red horseman of the apocalypse, that other leading personification of war in the postclassical iconographic tradition, the twentieth-century figure of War is geared to only one form of action: universal destruction, of civilization if not of the entire secular creation.

The mindless brutality, juggernaut action, and monster scale of the modern Mars lent itself to a further development particularly appropriate to the industrialization of warfare in the twentieth century as first fully revealed in the First World War. There are intimations in Alfred Kubin's turn-of-the-century personification *Der Krieg* (fig. 5.1), which transforms an archaic Mars into a monstrous cyborg, with steel-shod hoof, visored face, weighted battle axe, death's-head ribcage, and mechanical stride, whose scale, stance, and robotic advance create an implicit contrast with the perishable, bristling humanity its hoof is poised to flatten. Not a machine, however, but an uncanny hybrid of man, animal, and machine, its monstrosity—itself a trope of chaos—endows it with a dread more penetrating than that in L. J. Jordaan's clanking echo and successor, *De Robot* (fig. 5.2), an image now fully imbued with the experience of war in the century of the tank, the dive bomber, the submarine, and the thousand-gun barrage. Like the cartoonist Low's further metamorphosis of the brutal Mars into a walking atom bomb in the wake of another war and under the threat of world holocaust, Kubin's prewar nightmare reveals the contemporary specter-shape of armageddon.<sup>14</sup>



FIGURE 5.1. Alfred Kubin, *Der Krieg* (1903). Pen and ink drawing.

Source: © 2014 Eberhard Spangenberg / Artists Rights Society (ARS) New York. Photo: bpk, Berlin / Art Resource, NY.



The heart of the matter is how one wishes to characterize war. Consequently, even in an earlier age when artists and poets were prone to borrowing the persona of Mars to set forth the heroic virtues of kings, the image could also serve to personify the unmitigated brutality and destructiveness of war and its essential chaos. Such a Mars appears, amid a web of supporting significations, in the Peter Paul Rubens painting known as *The Horrors of War* (1638; [fig. 5.3](#)).<sup>15</sup> The horrors are represented here in figures like the hag Alecto and the emergent monstrous shapes of Famine and Plague rather than in unvarnished scenes of slaughter and starvation. In the far distance, just under Mars's bloody sword, there is a military battle discernable, but even so, it is the more human—though still allegorical—figures, thrust down and outward in the lower right-hand sector of the painting, driven before the sword, who give a taste of war as represented experience. Additionally (as an oil sketch after the painting makes clear), there is or was a fallen male figure between Mars's legs, face to the reddened ground, mouth open, leaden colored and altogether corpselike. The blood on Mars's sword can be read as having a source in action, as literal reality, not just as a proleptic or symbolic attribute.<sup>16</sup> For all that, the identification of war with chaos is as much in the structure of the painting as in its figuration and discursive program. The structure is based on the transformation from left to right, the sweep from firm vertical architecture (the Temple of Janus) and clear light—where Europa invokes the pity of some higher power—to murky confusion with red reflections of background fire and the dissolution of shapes in smoke and darkness. Chaos opens like a wedge, from the lower left till it fills the frame at the far right.



FIGURE 5.2. Leendert Juriaan Jordaan, *De Robot* (1940–1945), from *Nachtmerrie over Nederland* (Amsterdam, 1945).  
 Source: Atlas Van Stolk, Rotterdam, the Netherlands.



FIGURE 5.3. Peter Paul Rubens, *The Horrors of War* (1637–1638). Oil paint on canvas.  
 Source: Galleria Palatina, Rome. Photo: Erich Lessing / Art Resource, NY.

Rubens's program is stated substantially in an unusual letter written to the artist-agent

through whom he received the commission for the painting. His explanation, sent some weeks after the painting, reads in good part as follows:

The principal figure is Mars, who has left open the temple of Janus (which in time of peace, according to Roman custom, remained closed) and rushes forth with shield and blood-stained sword, threatening the people[s] with great disaster [ruina]. He pays little heed to Venus his mistress, who, being accompanied by her Amors and Cupids, strives with caresses and embraces to hold him. From the other side, Mars is dragged forward by the Fury Alekto, with a torch in her hand. Nearby are monsters, personifying [che significano] Pestilence and Famine, those inseparable partners of war. On the ground, turning her back, lies a woman with a broken lute, representing Harmony, which is incompatible with the discord of War. There is also a mother with a child in her arms, indicating that fecundity, procreation, and charity are thwarted by War, which corrupts and destroys everything. In addition, one sees an architect thrown on his back with his instruments in his hand, to show that that which in time of peace is constructed for the use and ornamentation of the City, is hurled to ground by the force of arms and falls to ruin. I believe, if I remember rightly, that you will find on the ground under the feet of Mars a book as well as a drawing on paper, to imply that he treads underfoot all the arts and letters. There ought also to be a bundle of darts or arrows, with the band which held them together undone; these when bound form the symbol of Concord. Beside them is the caduceus and an olive-branch, attribute of Peace; these also are cast aside. That grief-stricken [lugubre] woman clothed in black, with torn veil, robbed of all her jewels and other ornaments, is the unfortunate Europe who, for so many years now, has suffered plunder, outrage, and misery, which are so injurious to everyone that it is unnecessary to go into detail. Europe's attribute is the globe, borne by a small angel or genius, and surmounted by the cross, to symbolize the Christian world.<sup>17</sup>

Rubens painted the picture under the shadow of decades of war that, as a diplomat and artist, he had worked to avert. But war was endemic, sparing neither his homeland nor other nations, and appeared to be uncontrollable. Like the rightward precipitation of the action and the specificities of iconic detail, the language with which Rubens describes the scene that Jacob Burckhardt called “the immortal and unforgettable frontispiece to the Thirty Years’ War”<sup>18</sup> equates the eruption of war with the onset of chaos in the social and moral order of Europe and in the lives of its inhabitants. War is discord. It tramples on all the arts that grace civilization. It is inimical to generation itself; it “corrupts” and “destroys” whatever it touches. The distraught figure of Europe displays the violent outrages she has suffered in the dress torn to the loins, leaving much of her breast and undergarment exposed. The mother in flight looks back in fear while the child she is clutching protectively looks away in terror. Plague has the breasts and lion’s body of a sphinx; Famine, mouth gaping red and breathing smoke, is a bat-winged head with coiled serpent body, monstrosities that figure forth not simply their names but the underlying chaos that the transformation to war releases. Alekto herself is a hybrid figure, with a muscled, masculine body, dark hair with smoldering strands, heavy brow and shadowed jaw, in contrast to Venus, who is all soft femaleness. With Mars striding forward, oblivious to what he tramples and looking back toward a clinging Venus while Alekto hauls him in the direction pointed by her torch, the group suggests a parodic Choice of Hercules. The torch is an attribute of Discord, an emblem of passion and destruction. Through the gaps leading to the far background are a battle scene, storm, and buildings in flames.

A city in flames appears in the background of one of the most striking graphic commentaries on war as the instantiation of chaos. It is striking, not least, for its use of mirroring symmetry, the vivid means whereby it makes its point on pointlessness. Under the rubric *Discordia*, and using an emblem-book form of combined image and text, Johann Theodor de Bry links the death of reason, via dogmatic antithesis, to war imagined as mutually assured destruction. Himself displaced by the wars of religion of the sixteenth



century and living into the thirty-year conflagration of the seventeenth, de Bry represents Discordia in hypostasized absurdity as two ancient warriors, armed and accoutered, with embellished foolscaps, spiked foreheads, socketed peg legs and crutches, standing point to point and spear to spear. Each clutches a proclamation, one reading “Est,” the other “Non Est.” One has an owl perched on his hat (emblem here of ill-omen, darkness, and learned stupidity), the other the suggestion of ass’s ears. Each rests his good knee on an overturned globe with a cross, emblem of the world turned upside down (fig. 5.4). Under the image appears the text:

IT IS, IT'S NOT roil the league and harmony of the World,  
And further bring all back to ancient Chaos.  
Brows spiked, point to point they stand, armed alike,  
Both gimpy, neither stirs a single step.<sup>19</sup>

De Bry belonged to a family of Flemish Protestants forced to flee into exile in Germany by the religious wars and persecutions of the late sixteenth century. Though some of the family’s graphic art served a partisan polemic,<sup>20</sup> de Bry’s Discordia sums up a perception of futility and meaninglessness in the wars that had devastated his part of the world, and—whether through prudence or conviction—he generalizes (and infantilizes) the causes. In his letter explaining The Horrors of War, Rubens referred to the orb and cross as denoting the Christian world. The wars within Christendom had brought charges of sacrilege and fratricide all through the Middle Ages, and on the eve of the Reformation, Erasmus had deplored the absurdity of rival armies abetted by priests receiving the sacrament and rushing to battle under the standard of the cross. “Lo! crosses dashing against crosses, and Christ on this side firing bullets against Christ on the other: cross against cross and Christ against Christ”—again, a symmetry of the absurd.<sup>21</sup> After a century of wars within Christendom, wars not simply supported by religion but in the name of religion, war hardly seemed a mode of action climaxing and resolving in battle but rather an incubus that endured: war not as crisis but as condition.



FIGURE 5.4. Johann Theodore de Bry, Discordia. Engraved illustration, *Proscenium Vitae Humanae, sive Emblematum*

The emergence of such a sensibility in the climate of the Thirty Years War lies behind Callot's notable print series of 1633, the etchings entitled *The Miseries and Misfortunes of War*. It also prepared the ground for Hobbes's bleak portrait in *Leviathan* (1651) of the state of nature as a perpetual theater of war, with war as a condition like the weather. When Hobbes extends his vision by pointing to the relations between rulers even in the happier civil state, his description might as well have been written to accompany and explain de Bry's image:

Yet in all times, Kings, and Persons of Sovereigne authority, because of their Independency, are in continuall jealousies, and in the state and posture of Gladiators; having their weapons pointing, and their eyes fixed on one another; that is, their Forts, Garrisons, and Guns upon the Frontiers of their Kingdomes; and continuall Spyes upon their neighbours; which is a posture of War.<sup>22</sup>

As Hobbes saw it, it was the absence of a hegemonic sovereign authority over the sovereign nations that allowed the lineaments of primal chaos to peep forth, a chaos that could also break loose within a nation in fratricidal civil war.

The potency of de Bry's conception may be appreciated in its numerous later avatars, as in the recent half-century dominated by the commitment of two primary antagonists to a stance of "mutually assured destruction," or MAD, a strategy whose paradoxical rationality lay in its efficacy in keeping itself in a state of poised arrest. Close in spirit to de Bry's emblem is Gerald Scarfe's more local comment, *Sinking in a Sea of Blood* (1993), a rendering of two mummified skeletons, head to head, blasting each other in the crowded perforated coffin labeled "Northern Ireland" (fig. 5.5).<sup>23</sup> A variant, Tom Toles's *A Summary* (1995), maps the Bosnian impasse as a vertically organized, reversible, double-turreted tank housing respectively Serbia and Croatia and primed for mutual destruction (fig. 5.6).<sup>24</sup> Most interesting, most general, and in some ways closest to de Bry is Salvador Dali's drawing *Combat* (1955), where he revisits his surreal nightmare of 1936, *Soft Construction with Boiled Beans; Premonition of Civil War*. In that earlier unsettling painting, the mutant remains of two figures, only one whole arm and one leg between them, are locked in a horizontal trapezoid of anguished combat between sky and earth, the symmetries intensifying the madness. In *Combat*, however (fig. 5.7), the symmetries and balance (like the geometry) have been broken in violent disintegration, the body parts of the combatants shattering into streams of projectiles, with at least one monstrous mantislike leg echoing de Bry's prostheses. The further suggestion of a shattering of the symbols of the arts and of structure recalls that motif in Rubens. The drawing registers an emotion now less capable of enlisting ironies.





FIGURE 5.5. Gerald Scarfe, Sinking in a Sea of Blood (1993).  
 Source: Sunday Times (October 31, 1993). Image courtesy of Gerald Scarfe.

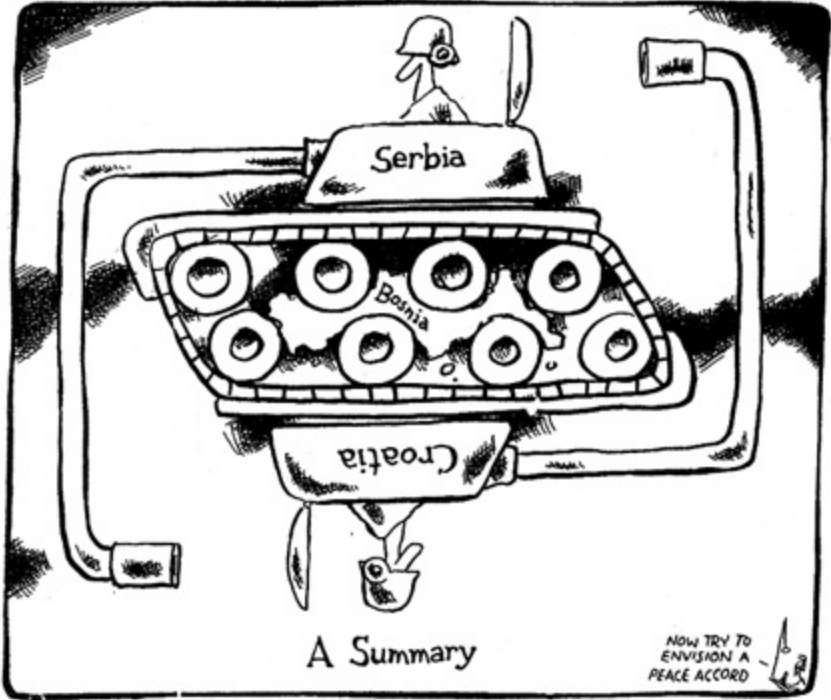


FIGURE 5.6. Tom Toles, A Summary (1995).

Source: From The Buffalo News (August 1995); New York Times (August 27, 1995).



FIGURE 5.7. Salvador Dalí, Combat (1955). Ink with wash.

Source: Salvador Dalí Museum, St. Petersburg, Florida. Image © Salvador Dalí, Fundació Gala-Salvador Dalí. Artists Rights Society (ARS), New York, 2014.

For an image to function emblematically, it does not (despite print convention) require a text. A laconic title may be enough, like that which turns Antoine-Augustin Préault's nineteenth-century phantasmagoria *Tuerie* from the echo of a fragment of a bas-relief into a symbol for all warfare. All that is required is the degree of abstraction and generality achieved in nominalizing the verb "to kill." "*Tuerie*"—the name is included in the sculpture—translates the fragmentary quality and the crowded disorder into the essence of an image of war as chaos (fig. 5.8).<sup>25</sup> Mostly interlaced heads and hands, it includes the torso of a figure with prominent chest wounds, head cast back and expiring, and an agon that seems to involve the juxtaposed heads of a cadaverous helmeted warrior and a grimacing bearded black man, teeth clenched, clutched by hands on face and crown. In the heap of tangled body parts, a woman, hair still in the grasp of a heavy, veined male hand, lies face up in death. Diagonally opposed, another such hand clutches the throat of the male head in full cry at upper right. Still another hand, holding a dead baby, most likely belongs to the screaming profile of the woman at the center, prefiguring the imagery of Picasso's *Guernica*. Hair flying, and thrusting just beneath the embossed word "*TUERIE*," she also evokes *Havoc* and the *Furies*. Compressing many motifs from the graphic traditions of the *Miseries of War*, the special horror of the scene is the crowding, in promiscuous confusion, of the interlaced fragments of the living, the dying, and the dead.



FIGURE 5.8. Antoine-Augustin Préault, *Tuerie* (1834). Bronze.

Source: Musée des Beaux-arts, Chartres. Image © RMN-Grand Palais / Art Resource, NY. Photo: Bulloz.

Such a confusion of life and death is at the heart of the extraordinary impact of Otto Dix's etching "Skull" (fig. 5.9). It is not title but context, however, that gives this print emblematic force as an image of war reduced to its essential chaos. "Skull" (Schädel) was part of a series of fifty etchings called *Der Krieg* (1924) reflecting the experience of the Great War. It stands out from the rest of the series (discussed below) in its metonymic simplification, its immediate isolation, its focus and scale. Though issued relatively late in the series, it has come to serve as a signboard and frontispiece for the series as a whole. The referential context that gives it symbolic resonance is the convention in art and elsewhere that makes the skull an emblem and reminder of death. That which gives it meaning with respect to war is the series as a whole. What brings it into the realm of chaos, however, is the scarcely imaginable, fully obscene swarm of life that knots and spills from every opening and that populates any remaining patch of flesh. Additionally, the wiry, worm-filled hair on the crown and in the mustache over the grinning, broken mouth seems almost alive in its own right. The shock and the obscenity come from the monstrous mingling, the offence to the categorical rigor that in most cultures divides living and dead flesh. The chaos is in the mingling but also in the vibrant competitive energy of the worms. The reciprocity between death and decay on the one hand and life albeit in a lower form on the other is a persistent motif in Dix's series and reflects attitudes derived both from modern science and Nietzschean vitalism. Like many of his generation, Dix entered the war with enthusiasm, as offering engagement with a deeper truth and a more intense reality. But the high-minded belief in strife and survival, will and mastery, as the basis of positive, creative ferment in an ongoing evolutionary order would yield in the light of experience, in the war's aftermath, to the devolutionary pessimism that was its incipient obverse. In *Schädel*, the categorical distinctions between life and death, creation and destruction, appear to have broken down, and the result is the unveiling of chaos.





FIGURE 5.9. Otto Dix, Schädel (Skull), from Der Krieg (The War) (1924). Etching, from a portfolio of fifty etching, aquatint, and drypoints, folio 4.1; plate: 25.5 × 19.6 cm; sheet: 46.4 × 34.8 cm.

Source: Publisher: Karl Nierendorf, Berlin. Printer: Otto Felsing, Berlin. Edition 70. Gift of Abby Aldrich Rockefeller. The Museum of Modern Art. Digital Image © The Museum of Modern Art / Licensed by SCALA / Art Resource, NY. © 2014 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn.

In the modern period, no painting has taken on status as an emblem of war and its chaos to rival Picasso’s Guernica. One critic, exasperated at its overexposure, calls it “the modern Mona Lisa.”<sup>26</sup> That it should occupy such a position is surprising for several reasons having to do both with the modernist vehicle and the question of the ultimate readability of the painting itself. And it leads to the conclusion that, for a popular emblematic image, it is the same as in Eliza Doolittle’s formulation in Shaw’s Pygmalion for what makes one a lady: what counts in the end is not how you behave but how you are treated.

Guernica (fig. 5.10) was painted in 1937 for a public and political purpose: as a mural in the Spanish Pavilion at the Paris World’s Fair commissioned by the wartime Spanish Republican government. Picasso chose the subject and began painting immediately after the destruction on April 26 of the ancient Basque town by German planes, the first application of Schrecklichkeit from the air in the run-up to the Second World War. Despite its public function, the painting speaks in part in a private language and in the idiom of the modernist elite. The symbol of the bull, for example, clearly a pivotal image, resists

interpretation and in consequence has been read as representing fascism; its opposite, heroic Spain and the Spanish people; and totemically (even oedipally) as Picasso himself.<sup>27</sup> The eye/sun/electric-light fixture is no less indeterminate. Modernism as a style is notoriously resistant to convertible meanings other than those that come out of its ontological and aesthetic self-scrutiny. Its successful alienation of a larger public proceeded from its disintegrative approach to representation and its unanchored, seemingly arbitrary, symbolism—better understood as an evacuation of commonly coded signification. Programmatically subversive, sometimes deliberately offensive, and compulsively innovative, it has often come to grief when enlisted as official art, both with its official sponsors and the larger public.



FIGURE 5.10. Pablo Picasso, *Guernica* (1937). Oil paint on canvas.

Source: Museo Nacional Centro de Arte Reina Sofia, Madrid. © 2014 Estate of Pablo Picasso / Artists Rights Society (ARS), New York.

Yet *Guernica* emerged as the most widely recognized painted image of the horror and chaos of war in the twentieth century, now ensconced in an official shrine amid the relics of its nativity. The vagaries of politics, history, and public relations are not a sufficient explanation for this success. Some of it lies in Picasso's selective exploration of particular affinities between his modernist idiom and his subject, some in an overall transparency that transcends local obscurities and unachieved (and indeed unsought) syntactic coherence.

Disjunction, fragmentation, collagist accumulation, shock and extremity, violence toward the spectator and the object: these were at home in the modernist idiom. "Chaotic" was a common term of abuse for its products, so often offensive to lingering canons of beauty, intelligibility, and familiarity, and ambient "chaos" in turn was a common justification for an art that belonged to the decentered and anomic modern world. But *Guernica* was a painting claiming in its title to depict or at least express something more specific than either general cultural fragmentation or the universalized miseries of war—with a specificity like the shout of a newspaper headline, emphasized by the photo-monochrome of the day, and the newsprint body of the screaming horse. "*Guernica*," as well as a place, was above all an event seen as exploding the limiting conventions forbidding the direct and indiscriminate waging of war against civilian populations. To the "normal" disruption and destructiveness of war and the understood intensified chaos of civil war was here added the blatant casting aside of the always problematic and precarious "laws of war." No achievement of the past



several centuries in the protocols of armed combat had seemed more important or fundamental than the distinction between the licensed and declared combatants and the civilian population. No propaganda in the late Great War had been more effective than reports of the violation of that distinction. “Guernica” brought chaos from the abstract to the particular, simultaneously evoking shock, outrage, fragmentation, and extremity—“all coherence gone”—in a time when, in Yeats’s famous phrase, “the tide of blood is loosed upon the world.” And the modernist idiom, as Picasso deployed it, visibly suited the disjunctive extremity.

Not, however, as anarchic mimesis. If a coherence that incorporates all detail and gives each figure relational meaning is absent in the program of the painting, there is an abstract architecture, classic in its balance and pediment form, end-stopped and contained despite the panoramic proportions and array. If terror, death, panic, and screaming anguish register an affective extremity, they are also rendered in monochrome, as a night scene (unlike the real event) where the violence of color gives way to the starkness of seeing in the range between black and white. If there is a tangle of figures within the central pyramid that includes the horse, and in that to the left dominated by the bull, each figure is in fact distinct in outline and essential detail (none without two eyes, for example), including the sprawling fragments of the fallen martial statue. But even such controls, if that is what they are, function ambivalently and contribute to the enactment of chaos while producing uniformities of field. As Rudolf Arnheim observes,

Like the monochrome, the long format has an equalizing effect.... Instead of tight cross-connections, there is a loose enumeration of similar happenings. The spectator’s eyes, traveling along the canvas, inspect a sequence of themes rather than encounter a highly integrated structure.... The world envisaged in Guernica is one in which much the same happens everywhere but without strong over-all organization.<sup>28</sup>

The description is of an entropic chaos, existing however in flash-bulb simultaneity with the catastrophic energy of the event.

The enumerated thematic array also incorporates a good deal of traditional imagery, which contributes to the overall transparency. The most evident is the anguished mother, breasts exposed, holding the dead child. Others are the fallen warrior, here a broken monumental sculpture; the screaming woman, arms upraised, here falling in flames; the fearful woman in flight; the pierced and dying horse, familiar in battle scenes (and not simply a figure from the bull ring); the house—that is, the city—on fire. The woman with the lamp, thrusting out of the window and viewing the scene, adds to the immediacy by joining perception and experience, spectator and participant. In the absence of causation—there is neither plane nor bomb—we are given an experiential chaos rather than a rational one with a visible generative logic (though the spear that skewers the horse and the upward screaming faces might suggest the direction of the attack). The painting is all effect rather than cause, flat in its temporal aspect just as it is flattened and stretched spatially. Instantaneousness, as in the woman and pillar in mid-fall, and duration, as in the stable stance of the bull and the unaffected eye/sun/light fixture, do not create a temporal perspective. The fallen warrior hints at time and history but in its shattered sprawl appears sufficiently human to be part of the anguished immediacy. Given the public purposes of the

painting, however, and the fact of a war in progress not yet lost, Picasso does provide a glimmer of something for the future beyond anguish and defeat (like the flower surviving between hoof and broken sword). Hence (I would judge) the ambiguity of the figure of the bull, and hence the multivalence of the fallen monument/warrior from whose open mouth the head and chest of the bull seem to emanate. The warrior lies dismembered, with broken sword and spear, present victim, shattered image of military glory and a heroic past, and perhaps in consequence prelude to a future without Mars.

This shattered Mars suggests one final contribution to the sense of immediacy and generality, strangeness and familiarity, that has helped make *Guernica* so potent an image of the chaos of war in the twentieth century. Many of the discrete elements in *Guernica*—e.g., the woman casting her arms in the air and looking skyward, the mother holding her child, the woman in flight, the fallen warrior, the thrusting female figure with arm extended and lamp (or torch) in hand—were to be found together in that earlier emblematic compendium, Rubens's *Horrors of War*. *Guernica*'s reference to Rubens's painting has by no means gone unnoticed.<sup>29</sup> Such allusive transformation is not unusual in Picasso's work; indeed, it is to be found in some of his greatest paintings. In the present case, he had not simply a great ancestor to co-opt and outdo but a baroque master to emulate in using an ontologically uninhibited range of figures to embody his uncontainable theme. Arnheim has argued that "by 1937 the art of painting had made possible a reality level at which deformities of shape and space and incongruities of subject matter portray the world as it is" (22). But in incorporating surreal intrusions with cubist simultaneity, latent geometry with analytic fragmentation, Picasso's painting treats the styles of modernism with the baroque freedom that permitted gods and personifications, monsters and putti, to share the scene with figures exemplifying human types and roles. Rubens's compendious painting, despite suggestions in the periphery, is not a war scene. It is concerned rather with causes and consequences, including the dynamics of the war spirit, and in its overall emblematic character represents war as a transition to chaos. In this, it is supported by its baroque rush and dynamic structure. Picasso's painting, despite some untethered symbolism largely in the upper reaches, is a war scene, overwhelmingly focused in the moment, absent cause and succession, and in its achieved emblematic character represents war as the achieved condition of chaos. In this it is supported by its modernist fragmentation, heterogeneity, and simultaneity. But before *Guernica*, the perception of war as the condition of chaos, extending beyond the crisis of battle and resisting the containment of a condensed temporal structure, lent itself to less-concentrated illustration and produced some of the masterpieces of writing and representation in the human effort to cope with its extremity.

## CONDITION

It was Hobbes who distinguished most memorably "that condition which is called Warre" from some of its salient incidents:

For WARRE, consisteth not in Battell onely, or the act of fighting; but in a tract of time, wherein the Will to contend by Battell is sufficiently known: and therefore the notion of Time, is to be considered in the nature of Warre; as it is in the

nature of Weather. For as the nature of Foul weather, lyeth not in a shewre or two of rain; but in an inclination thereto of many dayes together: So the nature of War, consisteth not in actuall fighting; but in the known disposition thereto, during all the time there is no assurance to the contrary. All other time is PEACE.<sup>30</sup>

War as foul weather, not an action but a climate, not a decisive structured event but a matter of unstructured duration, an unsettled condition full of insecurities and the unpredictable, spoke to the European experience in the sixteenth and seventeenth centuries. It spoke to Hobbes's own experience, writing in exile in Paris between the English civil wars and the years of the Fronde, in a retrospect of 150 years of endemic warfare mingling religion and politics. The quoted passage comes in the famous chapter of *Leviathan* where Hobbes lays out the "natural" state of man prior to the institution of civil government and finds it can aptly be characterized as war: war as an ambient and continuous condition, war carried to its distributed extreme "where every man is Enemy to every man."

In such condition, there is no place for Industry; because the fruit thereof is uncertain: and consequently no Culture of the Earth; no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society; and which is worst of all, continuall feare, and danger of violent death; And the life of man, solitary, poore, nasty, brutish, and short.

(96–97)

And to forestall a reader's taking his account of a climate of war that pits each against all as just a hypothetical historical fiction, he points to contemporary realities: the conditions prevailing among some native American peoples and between current European kings and magistrates.

The civil and social chaos Hobbes projects he partly frames in the rhetoric of negation so favored by the cosmological poets. He emphasizes its anomic character: "there is no Law: where no Law, no Injustice." The result is a loss of all distinction, moral as well as social: between right and wrong ("Force, and Fraud, are in warre the two Cardinall virtues"), between mine and thine, between one rank invested with authority and another with none. One might say that it is, in the sphere of men, the primal chaos of Genesis before division and distinction made a world and Adam was given its vice-regency.

Hobbes's treatment of war as condition rather than event elaborated the definition Hugo Grotius had offered a few years earlier in launching his great treatise on the law of nations. Noting that Cicero had defined war "as a contending by force," Grotius instead adopts a definition that regards war as "not a contest but a condition; thus war is the condition of those contending by force, viewed simply as such."<sup>31</sup> In characterizing that condition as no less subject to law, natural and "positive," than any other human activity, Grotius alludes to Erasmus and his great Dutch predecessor's very different approach to war and its weather. As far as war went, "viewed simply as such," Erasmus was closer to the Hobbesian view of its intrinsic lawlessness than to the argument of Grotius. More than a century earlier than both, Erasmus had launched an impassioned polemic against war as being antithetical to true civility and to all that made life valuable.

For Erasmus, war gains no legitimation through its social character. "What is war,

indeed, but murder shared by many, and brigandage, all the more immoral from being wider spread?"<sup>32</sup> He offers a progressive etiology, beginning with men banding together to protect themselves from wild beasts and reaching to the creation of empires through vast shedding of blood, by which "the supreme power had come into the hands of the worst rogues"—a narrative of degeneration into unconstrained violence quite opposite to Hobbes's narrative of the emergence of civil society from primitive violence and lawlessness with the establishment of a coercive sovereignty. Erasmus presents the current human condition as a limitless war, that is, as a social and moral chaos. Far from its defensive beginnings, "such a point of lunacy has been reached, as we see, that it fills the whole of life. We are continually at war, race against race, kingdom against kingdom, city against city, prince against prince, people against people" (320–321). Arguing the unnaturalness of war, he like Hamlet sets up a contrast between two portraits: of man as God and Nature made him and as he appears in "the picture of war." The latter begins with the cacophonies of battle, the mad uproar and the furious shock, the slaughtered in heaps, the wholesale butchery and the blood. In the blighting shadow of the campaign are "the trampled crops, the burnt-out farms, the villages set on fire, the cattle driven away, the girls raped, and the old men carried off captive, the churches sacked, robbery, pillage, violence and confusion everywhere"—a very compendium of the Miseries of War as it would descend in graphic illustration (in Callot's suite of the same name, for example) and in narrative description (as in Grimmelshausen's picaresque fiction). Complementing the immediate havoc is the grinding of the peasantry and the squeezing of the landowners, the desolation of the aged who have been bereaved, the women who have been widowed and the children orphaned. In the deepest perspective, war advances "the universal demoralisation of life," breeding contempt of duty and indifference to law. Finally, flood, plague, and monstrosity, the cognate imagery of chaos, take over the description of "this deadly pestilence [that] cannot be contained within its own limits...it floods like a contagious disease into the surrounding regions" and, breaking all bounds, proliferates like the Hydra (312–314).

A similar rhetoric of contrast and a recourse to the schematic tropes that signify chaos mark the work that supplies the epigraph for this chapter, Erasmus's *Complaint of Peace* (1517), where the personification of Peace despairs at the madness of men who would reject her and choose war at such great cost to themselves, war that is "one vast ocean, rushing on mankind, of all the united plagues and pestilences in nature."<sup>33</sup> War substitutes for a prosperous kingdom of flourishing cities and farmlands, of sound laws and moral habits, not just a scene of destruction but a world turned upside down. "If," says Peace, "you detest robbery and pillage, remember these are among the duties of war.... Do you shudder at the idea of murder? You cannot require to be told, that to commit it with dispatch, and by wholesale, constitutes the celebrated art of war"—along with rape, incest, and crimes of greater turpitude. "If you think that the very worst possible condition of society, when the worst of men possess the greatest share of power, you may take it as an infallible observation, that the wickedest, most unprincipled, and most unfeeling wretches bear the greatest sway in a state of war...such as would come to the gallows in time of peace"—the brigand, the housebreaker, the murderer, the incendiary (64–65).

Grotius explains Erasmus's pacifism as corrective in its intent, an unrestrained response

to the gross unrestraint among Christian nations in waging war, and designed to establish a true middle ground. Believing that all extreme argument is liable to be harmful, Grotius takes another tack, well illustrated in his incongruous chapter title, "Moderation in Laying Waste and Similar Things." In that chapter, while he recognizes the force of necessity and the claims of utility, not to mention those of retributive justice, in deciding "what devastation may be lawful," he is able at the same time to show how reason and prudence argue for military restraint. Grotius finds in history, both in recorded practice and stated principle, a thread through the labyrinth: limits and moderate alternatives that can be articulated into a coherent system of laws to contain the specter of chaos emergent in the condition of war. Erasmus sees only the chaos, and it was his vision that predominated in the powerful tradition of graphic illustration that claimed as its subject the "miseries," the "disasters," and the "horrors" of war.

## SOLDIERS AND PEASANTS: CALLOT

Three great suites of etchings stand out in the graphic tradition depicting the chaos of war. Their serial extension contributes to the rendering of war in all three as a climate of events rather than a climax. Each succeeding artist was conscious of his predecessor(s), in the choice of a medium that renders violence in monochrome, a process that entails acid biting into metal, and of an audience that would be diffuse and heterogeneous. The three series are Jacques Callot's *Les misères et les mal-heurs de la guerre* (1633), Francisco Goya's *Los desastres de la guerra* (etched 1810–1820), and Otto Dix's *Der Krieg* (1924). Spanning the centuries, they are also strikingly different from one another not only in manner but in matter, not only in scale but in thought. The differences go beyond those one must attribute to prevailing styles, technical means, markets, graphic languages, and even the artist's individuality. Some reflect changes in the waging of war over four centuries. These changes enter into the figuration of war as chaos, chaos as war.

Having lived and worked for ten years in Medici Florence, Callot returned to his native Lorraine with the Thirty Years War (1618–1648) well under way in the nearby Imperial (German) territories and with campaigns and sieges the order of the day in the Netherlands and Richelieu's France. His work now included commissions on the siege of Breda (1624–1625) and the siege and capitulation of La Rochelle (1628). Though Callot's *Misères* is surely linked specifically to the wars in progress, it is at the same time more generalized in its conception than the two later series. The condition of war that it reflects is indeed of the age, with its practices and participants (its soldiers are largely mercenaries), but it is not pinned to any particular event or locale, and it claims a certain universality. Goya's condition of war, on the other hand, reflects the particularity of the guerilla war against the French and its direct and collateral consequences in the Spain of 1808 and after; Dix's series wholly assimilates the condition of war to the grim stalemate of the Western Front in 1914–1918.

In representing the condition of war as a pervasive but episodic climate of violence, Callot's series enters into dialogue with another kind of representation and event, the



delimited scene of heroic and decisive battle. There was also, however, a mediating term in the contemporary artist's available repertory: the representation of an extended siege. The military historian J. R. Hale notes that as fortifications were modified to counter artillery in the sixteenth century, "pitched battles became rarer, making the siege, as the key to the outcome of a war, more newsworthy.... The siege-piece, then, became a genre subject of its own."<sup>34</sup> Callot's vast six-sheet rendering of *The Siege of Breda*, like most such pieces, compresses an extended period and a relatively static action within a panoramic scene organized for topographic description. Its affinity with the *Misères*, however, appears in what could be called the siege scene's genre-scene episodes. The view of Breda and its environs is as from a height, but in the immediate foreground is a peasant village with soldiers looting, stealing, driving off and killing animals, assaulting women, and shooting at fleeing peasants as others are beaten, stabbed, and robbed, while a kneeling woman pleads and a child flees in fear. In one episode the soldiers themselves are driven off by peasants armed with flails and other such implements. Elsewhere, still in the vein of genre, a one-legged veteran begs from officers on the march, soldiers gamble on a drumhead, in the besieger's camp (next plane) a soldier is undergoing punishment by strappado, and two corpses hang from an improvised gallows. It is precisely such incidents that move from sideshow to center in Callot's generalizing series on the sufferings and evils of war.

The reduction of Breda and, still more, Protestant La Rochelle, and the campaigns that were turning the German lands into an anarchic wasteland, could not but appear as a renewal and continuation of the religious wars of the previous century, an epoch reflected in Agrippa d'Aubigné's grand Protestant epic without a hero *Les tragiques*. Published only in 1616, on the eve of the Thirty Years War, the first section bore the title "*Misères*" and presents the devastation that the previous century had brought upon the land and people of France. It offers a descriptive panorama of lawless pillage, wanton destruction and abuse, a landscape of suffering within which the incidents in Callot's series would be at home. D'Aubigné sees the state of France in the condition of civil war as a *monde à l'envers*, where the wicked are empowered and the virtuous suffer. But his principal focus in the "*Misères*" is the earth and those who till it, whose reward for labor is pillage of crop and cattle, dispossession and starvation in the forests among the beasts. He evokes a spectacle of abandoned villages, of desperate attempts to cultivate sustenance, and of the alternatives to flight and starvation: houses turned into sepulchres and prisons, where the inhabitants are hoist by the thumbs, tied to faggots and set in the fire, their infants torn from the breast, hung by the heels, or left to starve in their cradles after the parents have been killed. Like Goya later, he reports, he says, what he himself has seen in the field: the *reistre noir* (the mercenary German *Reiter* or horse-soldier) "blast across the stricken habitations of France, and like a tempest, carry off whatever he can, destroy all the rest."<sup>35</sup> In the wake of this destructive horde, he encounters the horror of Montmoreau, where, out of a thousand houses, nothing is left but corpses and flames and hunger. He encounters a perishing family, husband, pregnant wife, and child, brutalized and left for dead for having nothing to give and for not understanding the demand itself. He tells of animals run wild and humans resorting to carrion and cannibalism for food, including the gruesome instance of a mad mother butchering and eating the flesh of her own infant. War here is nothing but an

unmitigated chaos, a systematic, detailed, and seemingly universal reversal of every social principle and natural relation, notably that between the land and its inhabitants. Chaos is articulated as an elemental and sacrilegious perversion of the very earth and its bounties within the schema of the four elements, which—to contain the chaos—helps structure the poetic whole of *Les Tragiques*.

Much of the condition of war that D'Aubigné details in his “*Misères*” finds a counterpart in the imagery of Callot’s *Misères et mal-heurs*. In the half-century between D'Aubigné’s participation and Callot’s exposure to war both catastrophic and endemic, little enough had changed in the experience of the land and its peoples. It is notable that in the generalized condition that Callot depicts, only one of the seventeen scenes after the title plate is the depiction of a regular battle (*Misères* 3, [fig. 5.11](#)). It follows the orderly opening scene of enlistment and troop formation, and, by its early placement and its generic rendering, it is effectively absorbed in the whole—not a climax, but just one life-destroying episode in the general experience and condition of war. The battle is rendered as a narrow band in the middle ground under billowing smoke and sky that occupies well over half the image, only about three by seven inches. What we see is a laterally extended *mêlée*, with cavalry charging in at the right toward the central encounter and riding off left, and two groups of infantry meeting in the background. The figures are tiny, and even the dead men and horses in the foreground are not (save in sprawl) individualized. Coming immediately after the scene of enrollment, the battle and the slaughter are certainly chaotic by contrast, but battle is only the beginning rather than a consummation of the miseries and misfortunes of war.

It is sometimes forgotten that the protagonist of Callot’s series is manifestly the soldier in his collective identity and trajectory, from enrollment to discharge; the soldier who is not only the principal actor but a principal sufferer. To the extent that the general condition of violence and destruction is organized into a narrative, it is his typified story. He is the vector of chaos with respect to the norms and foundations of civil life, but it is a chaos that redounds upon his own head. Of the thirteen scenes of violence among seventeen scenes altogether (plus title), five depict brutal crimes of pillage and destruction against the civilian population. In the remainder, violence is exercised against the soldiers, including five scenes of public torture and execution (“*The Strappado*,” “*The Hanging*,” “*The Firing Squad*,” “*The Stake*,” “*The Wheel*”) and a further scene of dire peasant vengeance on their abusers. Of the scenes without violence, two near the end show the grim fate of soldiering in the aftermath of war and battle: “*The Hospital*,” with its outdoor lineup of mutilated veterans, many legless, some crawling, seeking charity, and “*The Mendicant and the Dying*,” with the former terrors starving on the street of a battered town, begging from bystanders, bartering away weapons, and receiving last rites. The scenes of public torture and execution, notably the breaking on the wheel (M. 14, [fig. 5.12](#)) and the multiple hangings from a great spreading tree (M. 11, [fig. 5.13](#)), are the most memorable of the series, though the barbarous “*Strappado*” and the “*Firing Squad*,” with its discreet complement of waiting and laid-out victims, are not far behind. But though the victims here are presumably those soldiers who had inflicted the greatest suffering on the inhabitants of the ravaged land, their undisciplined anarchy now subject to the harsh discipline of the camp, in the overall effect the lines between the military and the civilian experience blur. The logic of retributive justice

gets lost in the prevailing and cumulative violence, and all are included in the “miseries and evil-times” that define the condition of war.



FIGURE 5.11. Jacques Callot, La bataille (The battle). Etching, from Les misères et mal-heurs de la guerre (1633), plate 3.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.



FIGURE 5.12. Jacques Callot, La roue (The wheel). Etching, from Les misères et mal-heurs de la guerre (1633), plate 14.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.

The latter part of the seventeenth century saw dramatic changes in the social organization of war, from what Sir George Clark has described as essentially “collisions of communities,” both within and between states, to “a great strengthening of the control of the States over war.” Before this “étatisation,” war was considerably more anarchic and unpredictable in its conduct and its forces, its onset and its conclusion, though “even at the end of the period there was still something of all this, for war is destruction.”<sup>36</sup> The impetus toward such étatisation is arguably present in the structural gestures toward control and containment in Callot’s series, from its framing to its balance of sufferings. Before venturing on his “large” series, Callot began a smaller one, smaller in size and number, on the theme of the miseries of war, issued only after his death.<sup>37</sup> Taken as a whole, its six scenes offer a simpler and more coherent sequence. It opens with “The Encampment,” soldiers and camp followers in a tented bivouac (the only scene without a close counterpart in the large series), and closes with “The Hospital.” Between are scenes showing soldiers committing highway robbery and murder; committing murder, arson, looting, and abduction at a monastery; pillaging and burning a village; and suffering “The Revenge of the Peasants,” a

retributive massacre of comparable brutality. The small series lacks entirely the powerful sequence of military punishments and executions. And to follow the peasants' revenge on the soldiers, there is no concluding "Distribution of Rewards," the final plate of the large series, whose iconic symmetry argues for an end-stopped containment of the violence and the chaos (the prince is elevated and enthroned in an architectural frame between arched bays and two lateral groups of courtiers and banners). As a conclusion, the scene somewhat perfunctorily complements the earlier elaboration of punishments (a kneeling figure, almost lost among the soldiers and courtiers at left, receives a ribbon), but much more than those prior scenes of judicial torture and execution, it implies the reining in and even full harnessing of the destructive forces of war to the purposes of the state. The final scene of royal recompense, moreover, forms a parenthesis with the emblematic title page of the large series, where the lettering is framed by a number of dashing figures in contemporary dress and arms, swaggered draperies, armor, trumpets, and up front the trophies of war in panoply, an assemblage of cannons, drums, and other weaponry, all redolent of la gloire, and centering on a crown. However, just as the justice of the military punishments is lost in the cruelty and horror they share with the marauders' offenses, so the notes of glorification that frame the series are overwhelmed by the weight of the misery and anarchy suffered by soldier and civilian alike.



FIGURE 5.13. Jacques Callot, La pendaison (The hanging). Etching, from Les misères et mal-heurs de la guerre (1633), plate 11.

Source: Yale University Art Gallery. Gift of Mrs. Cornelius Vanderbilt.

The frame in fact works less to contain than to emphasize what lies within, the chaos of war as condition. The first plate after the title is in this sense part of the frame (M. 2, [fig. 5.14](#)). It shows bodies of troops lined up in homogeneous companies—horse, infantry, and musketeers—while in the foreground, right and left, at table and drumhead, officers enlist recruits into the soldier's career. A castle in the left background balances the tents at right. The regularity in the clustered arrays and parallel lines of the infantry's long pikes—a hedge across the middle ground—and the uniform angle of the shouldered muskets in the formations reinforce the general sense of purposive order. The regularity and company order is seen dissolving in the second plate, the scene of battle, both in the central mêlée of the cavalry—disorder at the full—and in the background collision of the two infantry groups as the pikes descend to the encounter.<sup>38</sup>



The scenes that follow, of marauding violence (M. 4 and M. 8), systematic pillage and arson (M. 7, [fig. 5.15](#)), sacrilegious violation of place and persons (M.6), tend to depict soldiers in bands and companies pursuing separate actions in a localized scene of general ruin. All the scenes are exteriors with one exception, set apparently in the kitchens of a country manor or large farmhouse. This scene (M.5, [fig.5.16](#)) shows among other things a group of soldiers (right center) roasting a man hanging by the heels over a fire while another victim, feet to the flames, trussed and threatened with a sword, is forced to watch; two soldiers preparing to rape a woman on a raised bed; soldiers beside the open wine cellar threatening a man on his knees while a woman runs in from the side with the money they seek. In the left foreground a soldier in pursuit of a woman seizes her by the hair; another is in the act of stabbing a man on the floor. At center soldiers plunder a larder, with slaughtered animals lying beside them. At right others are plundering a chest; another rape can be glimpsed through the door. The accompanying verse inscription (by “the too fertile Abbé de Marolles”) takes note of the ubiquity and transgressive extremity whereby “all with one accord wickedly commit / Robbery, abduction, murder, and rape.”<sup>39</sup>



FIGURE 5.14. Jacques Callot, L'enrolement des troupes (The enlistment). Etching, from Les misères et mal-heurs de la guerre (1633), plate 2.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.



FIGURE 5.15. Jacques Callot, Le pillage et incendie d'un village (Sack and arson of a village). Etching, from Les misères et mal-heurs de la guerre (1633), plate 7.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.



The components of this scene and others showing the condition of war in village and countryside are prominent in the most remarkable literary depiction of the period of the Thirty Year War, Hans Jacob Christoffel von Grimmelshausen's *Simplicius Simplicissimus* (1669).<sup>40</sup> Drawing on the author's own experiences in the 1630s and 1640s, the novel conveys what it is to live in a permanent theater of war, an unstable world whose shocks and changes provide the protagonist with his education. Among the first of these events is the sacking of the family's house and farm, as seen through the narrator's once naive eye. After stabling their horses, he writes, the troopers "each fell to his appointed task: which task was neither more nor less than ruin and destruction." Some slaughter the cattle, others storm through the house, stripping it of household stuff, apparel, and provisions, destroying what they had no mind to take. They burn the furniture in the yard and break the stove and windows.



FIGURE 5.16. Jacques Callot, *Le pillage d'une ferme* (Sack of a farmhouse). Etching, from *Les misères et mal-heurs de la guerre* (1633), plate 5.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.

Our maid was so handled in the stable that she could not come out; which is a shame to tell of. Our man they laid bound upon the ground, thrust a gag into his mouth, and poured a pailful of filthy [dung] water into his body: and by this, which they called a Swedish draught, they forced him to lead a party of them to another place where they captured men and beasts, and brought them back to our farm, in which company were my dad, my mother, and our Ursula.

And now they began: first to take the flints out of their pistols and in place of them to jam the peasants' thumbs in and so to torture the poor rogues as if they had been about the burning of witches: for one of them they had taken they thrust into the baking oven and there lit a fire under him, although he had as yet confessed no crime: as for another, they put a cord round his head and so twisted it tight with a piece of wood that the blood gushed from his nose and mouth and ears. In a word each had his device to torture the peasants, and each peasant his several torture.... Of the women, girls, and maidservants whom they took, I have not much to say in particular, for the soldiers would not have me see how they dealt with them. Yet this I know, that one heard some of them scream most piteously in divers corners of the house; and well I can judge it fared no better with my mother and our Ursel than with the rest.

(book 1, chap. 4, pp. 8–10)

Grimmelshausen's narrative consistently underlines the abiding mutual antipathy of peasant and soldier, producer and destroyer. In the soldiers' locustlike passage over the land, there is no distinction between forage and pillage. But the antipathy is rooted in more than a history of rough-and-ready predation. It lies in the fundamental situation of a population exposed to outsiders with an unbalanced advantage in force, in circumstances where, for the invaders, the restraints and inhibitions of domestic and communal life have no

purchase, a climate where anything goes. The free release of aggression and appetite, further licensed by the strangeness of the other and danger to oneself, has not infrequently been the main attraction of the warrior's life, and it lives on in the culture of the ranks in modern armies, to say nothing of the forces, regular and irregular, in the ethnic and religious conflicts that plague the present world. After some horrendous chapters of reciprocal brutalities between a company of soldiers, who plunder and burn an entire village, and groups of armed peasants, including graphic instances of mass murder, humiliation, torture, mutilation, soul killing, and live burial (book 1, chaps. 13–14), *Simplicissimus*, now a few steps on the road to knowledge, reflects on the rooted antipathy between soldier and peasant:

I pondered not so much upon my food and my [preservation] as upon the enmity [Antipathia] which there is ever between soldiers and peasants. Yet could my foolish mind come to no other conclusion than this—that there must of a surety be two races of men in the world, and not one only, descended from Adam, but two, wild and tame, like other unreasoning beasts, and therefore pursuing one another so cruelly.

(book 1, chap. 15, p. 32).

Subsequently, *Simplicissimus* reports an emblematic dream, a grim recasting of such anodyne organic images of the body politic as the fable of the belly and the members in Shakespeare's *Coriolanus*. *Simplicissimus* dreams of a forest of trees, each with a "Cavalier" at the top, with soldiers of all types and ranks in place of leaves, and resting on roots made up of laborers and mechanics but mostly of peasants. It is these who give the tree its strength and bear the whole weight, and when not enough is squeezed out of them, "then did the commissaries so handle them with rods...that sighs came from their heart, tears from their eyes, blood from their nails, and marrow from their bones" (book 1, chap. 15, p. 33).

*Simplicissimus*, taking note of the military hierarchies, shows a certain amount of ambivalent empathy for the lowest rank, the Landsknecht, however ornery, tyrannical, godless, and insupportably burdensome, and very little for his noble superiors, who cheat him and refuse him all chances to rise through merit. A soldier himself in his later adventures, and even one of the brotherhood of marauders belonging to the vast number of the unhorsed and the unregimented plaguing the land, *Simplicissimus* will come to take an offhand attitude toward raiding for cattle and other depredations, a distinct shift in perspective. Grimmelshausen thereby manages to put us in both positions in the ancient war that cuts across other divisions, the war between peasant and soldier. In the end, however, it is the Landsknecht who in his own person best encapsulates the chaos of the condition of war. *Simplicissimus* reports a rhyme upon him: "Hunger and thirst, and cold and heat, and work and woe, and all we meet: / And deeds of blood and deeds of shame, all may ye put to the landsknecht's name." These rhymes, he avers,

were the less likely to be lyingly invented in that they answered to the facts. For gluttony and drunkenness, hunger and thirst, wenching and dicing and playing, riot and roaring, murdering and being murdered, slaying and being slain, torturing and being tortured, hunting and being hunted, harrying and being harried, robbing and being robbed, frightening and being frightened, causing trouble and suffering trouble, beating and being beaten: in a word, hurting and harming, and in turn being hurt and harmed—this was their whole life.

Here as elsewhere paralleling Callot, he adds that little by little “they perish, they die, they rot and consume away, save but a few, who in their old age, unless they have been right thrifty reivers and robbers, do furnish us with the best of all beggars and vagabonds” (book 1, chap. 16, pp. 33–34).

The end of Simplicissimus’s dream is a storm of the trees crashing into one another with great slaughter and ruin and finally the ambiguous vision of an alternative world in which “all trees I saw were one tree, at whose top sat the war-god Mars, and which covered with its branches all Europe. It seemed to me this tree could have overshadowed the whole world,” but instead it is blown about and brought to ruin by civil war and the strife of brothers, so that “All’s topsy-turvy turned [umbgekehrt] and misery hath ensued” (book 1, chap. 17, p. 39). The degree to which the eye can become accustomed to such a sustained antiorder is given poignant expression in the fifth and last book, when Simplicissimus, crossing into Switzerland, is shocked with a vision of normality which, “in comparison with other German lands...seemed to me as strange as if I had been in Brazil or China” (book 5, chap. 1, p. 304).

In Callot’s *Misères*, war carried to the population of village and countryside is well represented, but in the subsequent military punishments, designed (if one were to credit the rubrics) to fit the crime, retribution for crimes against the peasants as a group or class is not equally well represented. Malefactors labeled traitors, for example, are executed by firing squad, and incendiaries and looters of churches are burned at the stake. What happens between peasant and soldier requires a wilder form of justice, one deployed in a graphically different setting. The official punishments are staged scenes, as in the case of “The Wheel” (M. 14, [fig.5.12](#)). The disciplinary point of the exercise requires the presence of the assembled troops, with pikes restored to the verticality and spacing of the first forming-up, muskets to their regularity, and companies to their homogeneity. The show takes place on a raised platform where the two representatives of the sphere of order, the priest with his cross and the executioner with his iron rod, administer their respective comforts to the ex-soldier and criminal, his gear piled at the platform’s edge. Another victim is being prepared in the left foreground. Through the supports of the platform are visible some members of the general public, but the occasion is very much in the family. The added verses suggest that such justice (of “the divine Astrea”) will banish entirely a country’s grief and pain and that the robber who toyed with, ambushed, and murdered travelers here becomes the plaything of a wheel.

That the country is not so easily satisfied appears in the penultimate scene of the series (M. 17, [fig. 5. 17](#)), a scene of ambush set in a wood at the edge of a village. There are peasants in and behind trees on both sides firing guns, but most of the peasants are armed with flails, pitchforks, scythes, and clubs, against the soldiers’ swords. Some of those are in flight at left, while in the right foreground, closest to the viewer, a downed and terrified soldier asks mercy, holding up a purse, as he is pitchforked and clubbed for his pains. In the center foreground, peasants strip the dead and finish off the dying. Further back, behind a punctured drum, a cart piled with baggage and camp followers is under attack. Overhead, a corpse hangs from a dead tree. The scene is every bit as savage as those it is meant to revenge, its savagery enhanced by the woodland setting, its fragmented, distributed

activity, and the wicked look of the repurposed agricultural implements. It is a scene that risks imbalance, meant to convey a descent into anarchy. It is fraught with the reversal of roles and the overturn of occupationally appropriate behavior. Rather than a compensatory action that restores the balance in a violated order, it is offered as the furthest expression of the climate of chaos unleashed in a theater of war.



FIGURE 5.17. Jacques Callot, *La revanche des paysans* (Revenge of the peasants). Etching from *Les misères et mal-heurs de la Guerre* (1633), plate 17.

Source: Yale University Art Gallery. University Purchase, Everett V. Meeks Fund.

J. R. Hale, looking to earlier art, writes of the long tradition of representing “soldiers pillaging and committing atrocities against civilians” from Netherlandish manuscript illustrations forward. He notes in particular an astronomical portrayal of Mars and his “children,” with soldiers looting and killing villagers and setting fire to their houses. On “the visual theme of war’s by-blows against raped, humiliated and slaughtered women,” however—a theme well represented in Callot as it is in *Grimmelshausen*—the earlier secular art is “almost silent,” at least as compared to the moralists and chroniclers. There is no direct evidence that connects *Grimmelshausen*’s narrative to Callot’s graphic series, similarly rooted in the conditions of the Thirty Years’ War. Yet there is much overlap in detail and conception, notably in the marauding scenes, the battle scene, the war of peasant and soldier, and the narrative of the soldier’s career and his misfortunes. Even Callot’s terrible image of the hanging tree suggests something of *Simplicissimus*’s dream of a hegemonic universal order; only, in the dream, Callot’s hanged troopers, “comme fruits malheureux,” appear as both a hierarchalized burden and “a perpetual climbing and swarming” (book 1, chap. 16, p. 35), whereby the great tree is brought to chaotic ruin by the winds of its own unquenchable dissensions.<sup>41</sup>

## GOYA’S NIGHTMARE

Commentators on the origins of Francisco Goya’s great and profoundly disturbing suite of etchings posthumously named *The Disasters of War* regularly invoke Callot’s *Les misères et mal-heurs de la guerre* as its unique serial predecessor. But the debt serves to underline



the differences, notably in heat and intimacy, the artist's expressive involvement and the viewer's permitted distance. In a general comparison in which he acknowledges the mannerist extravagance of Callot's style, Théophile Gautier nevertheless finds him, compared to Goya, clear, precise, and even in his diableries faithful to realities and the realm of the possible. He notices that the broad daylight and precise detail in Callot's etchings mean forgoing "effect" and chiaroscuro, whereas Goya's compositions belong to "deepest night, wherein some sudden ray of light sketches pale silhouettes and strange phantoms."<sup>42</sup> Though most of Goya's Disasters are actually not identifiable as night scenes (and he did not control the final appearance of the published work, which almost certainly darkens the intended image), it is nevertheless a nightmare world that emerges in the shades and toning of his graphic palette, in the isolation of scenes in uncharacterized space, in the viewer's recurrent difficulties in giving coherence to shape—and elsewhere being shown more than we want to see. It is a vision that at once engages and punishes seeing, bringing the nightmare close and locating it in a historical reality.

The presence of Callot in Goya's artistic lineage was not confined to the precedent of the *Malheurs*. It was Callot who first used the term *Capricci* as the title of a suite of prints, a term Goya invoked and recast for his first great graphic series, *Los caprichos* (1799).<sup>43</sup> For Callot, his fanciful miscellany was at a far remove from his series on war with its grim focus, defined subject, and implicit narrative. For Goya, however, it was otherwise. The majority of scenes in the Disasters implicitly or explicitly derive from observed reality (he titles two successive plates, nos. 44 and 45, *Yo lo vi*, "I saw it," and *Y esto tambien*, "And this too"), but also in the series are some scenes, symbolic and fantastic, that he called "*caprichos enfáticos*." As coda and punctuation, these serve as commentary and enlarge the frame. They declare that the chaos released by war in the Spain of 1808 to 1812 is not so readily distinguished from other regimes of extreme disorder, in mind, spirit, and society; nor is it so easily defined by contrast with a "normal" world at peace.

Goya is an artist with many faces—court painter, religious painter, portraitist, satirist, and fantasist—and his work is expressive of the contending certainties and ambivalences of his time. But for all the professionalism such versatility implies, he was also an artist whose work bears a deep-dyed subjective stamp, elusive in its final privacy. He is an artist whose most disturbing work confronts the immanence of chaos—and the challenge of its representation. The Disasters of War belongs to this strain in Goya's work, a strain that includes *Los caprichos*, the later print series *Dispartes*, as well as the famous "black paintings" from the walls of his home, "The House of the Deaf Man." In a way, the Disasters of War is the least problematic series among them, in having in the subject of actual war—war experienced as a lawless, totalizing condition, as a madness—an objective correlative for the nightmare of chaos that threatens the mind and the universe. In Goya's art, the two threats are not divided.

Goya's annunciatory etching from the *Caprichos*, of a sleeping figure (to be understood as the artist) beset by outsize nocturnal animals, bears the much-cited legend, "The sleep [or dream, *sueño*] of reason produces monsters." This is commonly read in an Enlightenment spirit as enjoining reason's check on the imagination, or at least the conscious collaboration of reason and imagination.<sup>44</sup> It offers a range of other possibilities,



however, reinforced in the atmosphere of the Caprichos and carrying into Goya's other work. The power of the dream, the vividness, ubiquity, and reality of the embodied irrational in the prints is such that it tends to overshadow the primacy of the waking state. By the time of the Disasters, reflecting the mutual atrocities of the guerilla war, the concomitant visitations of hunger and pestilence, and the repressions of the reactionary aftermath, the efficacy of reason as a restraining, let alone a liberating, agent, the midwife of a new and better order grounded on truth as opposed to privilege, superstition, and force, required a faith that had worn very thin.

Goya's representation of war has the character of an unmasking, a light thrown into the primitive darkness holding the monsters that are both our creation and the inwardness of an intolerable reality. In the final order he assigned to the eighty-plus plates (in a period of political thaw when publication seemed a possibility), the first, bearing the legend, "Sad presentiments of things to come" (*Tristes presentimientos de lo que ha de acontecer*), shows a kneeling, ragged figure, arms spread more demonstratively than imploringly, eyes upcast, while in the dark rough-scrawled background hinting of wall and cave lurk inchoate shapes and intimations of monstrosity (fig. 5.18). Among the most resonant of Goya's prints is no. 69 (fig. 5.19), one of the fifteen or so caprichos enfáticos that conclude the series. It shows a half-buried, desiccated corpse and a tablet upon which he has written the single word, "Nada." From the surrounding murk he is seemingly beset by the suggestion of demonic and bestial faces; among other hinted shapes is a shadowy figure holding a collapsed set of balances, the scales of justice. Such monsters, demonic and indeterminate, appear elsewhere, where the darkness is, as it were, condensed. But such symbolic embodiments of the evil in and around the chaos of war are no more monstrous than what purports to be the direct representations of experience. The war that Goya depicts is the revelation of what lies beneath the mask of the ordinary and the accepted. The Nada plate is preceded by the capricho image (no. 68) of a squatting clerical figure in chamber-pot position (fig. 5.20), one hand holding a spoon, between, on one side, great heaps of symbolic rubbish—religious paintings, votive objects, a crutch, a child's dress—and, on the other, a pile of masks, symbolic and grotesque. In the background are shadowy outlines of a procession of hooded figures. The legend reads, "What madness!" (*Que locura!*). As in the scenes representing the actualities of war, so in society at large in the Spain of 1808–1812: the gross reality under the carnival masks and delusive superstitions is revealed as the supremacy of appetite and unreason.



FIGURE 5.18. Francisco de Goya, Tristes presentimientos de lo que ha de acontecer (Sad presentiments of things to come). Etching, burin, drypoint, and burnisher, from The Disasters of War (1810–1820), 1.

Source: Yale University Art Gallery, University Purchase.



FIGURE 5.19. Francisco de Goya, Nada. Ello lo dice (Nothing. That's what it says). Working proof, etching, burnished aquatint, lavis, drypoint, and burin. From The Disasters of War 69, renumbered and retitled Nada. Ello dirá (Nothing. Time will tell).

Source: Digital image © Trustees of the British Museum.



FIGURE 5.20. Francisco de Goya, *Que locura! (What madness!)*. Etching, lavis, and burin, from *The Disasters of War* 68.

Source: Yale University Art Gallery, Arthur Ross Collection.

The war Goya depicts is, like Callot's, without heroes and without resolving climax.<sup>45</sup> There is no traditional battle scene. It is an "asymmetric" war, one not of disciplined armies meeting in the field but of occupation, resistance, revenge, and repression. To the violence of soldiers and irregulars against each other and the civilian population are added the disasters of famine, displacement, disease, and death. These are the subject of the fifty-six plates from Goya's earliest numbering that reappear in his final arrangement, renumbered and augmented. And these are what is meant by the first part of the title, almost certainly of Goya's providing, on the album of proofs from his lifetime.<sup>46</sup> Now a suite of eighty-two images, they were called collectively *Fatales consecuencias de la sangrienta guerra en España con Buonaparte. Y otros caprichos enfáticos* ("Fatal Consequences of the Bloody War in Spain with Bonaparte. And Other Striking Caprichos"). The "fatal consequences" are the war, and the term embraces both the violence and the suffering. Though the series was not published in its entirety until 1863, when it was given the title by which it is generally known, Gautier knew at least twenty of the plates in 1845 under the rubric "Scenes of Invasion" and characterized them as nothing but "hanged persons, heaps of corpses being stripped, women being raped, wounded taken away, prisoners shot, convents cleaned out, populations in flight, families reduced to beggary, patriots garroted."<sup>47</sup>

Many of these actions reflect established motifs but now often pushed beyond their established limits. Mothers with young or infant children appear in twelve of the plates, church looting and priest killing in two. There are five scenes of rape, incipient or in act; five of deliberate mutilation; and a scene of what appears to be the moment before a civilian massacre (no. 26, *No se puede mirar* ["One cannot look at this"]). Bodies, male and female, dead and alive, are stripped in more than a dozen scenes of violence, past or in progress. The scaffold and the firing squad, augmented by other distinctively Spanish forms of public execution such as the garrote, appear here as in Callot, but with a difference. In Callot it is the military that suffers these punitive malheurs, as it is the military in the end that endures beggary and mutilation. In Goya it is the general population that suffers all these



things, in addition to the less formalized terrors.

The war between peasant and soldier is here broadened to include the civilian population at large, and the single scene of reversal in Callot, showing the peasants' revenge, here expands into the guerilla war (the very term for such irregular bands and tactics being part of Spain's contribution to world language). The second plate, *Con razon ó sin ella* ("With or without reason," or, perhaps, "Rightly or not"), shows a confrontation between soldiers, pointing musket and bayonet, and wounded guerillas, pointing dagger and pike in the foreground of a skirmish, while the third (captioned "The same") shows three men in peasant dress wielding axe, knife, and teeth in the slaughter of fallen hussars (fig. 5.21). The opening sequence focuses on such violent resistance, and notably that of the women, whose Amazonian fierceness is a symptom of the prevailing chaos. Plate 5, *Y son fieras* ("And [they] are wild beasts") shows one barefoot woman with a pike, infant under her arm, spearing a soldier, while her sisters wield knife, rock, and sword (fig. 5.22). Women are at the center of seven of the first thirteen plates, including that recalling the legendary Maid of Saragossa. A series of rape scenes (nos. 9, 10, 11, 13) begins with an assault and resistance over the caption *No quieren* ("They don't want to"). Here, in the assaulted woman's strong, wide stance and the soldier's locked arms, bent and confining knees, and lowering face, undeterred despite being clawed, we see an impasse that a second older woman, knife poised and fist clenched with determination, is about to break (fig. 5.23). The motif of the people's revenge takes another form in two brutal scenes that represent mob lynchings (nos. 28 and 29) and most likely reflect the mob actions against suspected French sympathizers and resident French civilians. In the first scene, *Populacho* ("Rabble"), the prone figure, dragged on a rope with buttocks and legs exposed, is about to be battered and possibly hamstrung (fig. 5.24). The victims have no military identity. Like the scene of execution showing a bound victim being hauled up the ladder of a gallows by other civilians, with a priest offering his comfortless word and earlier victims strung up in the background (no. 14), such scenes bespeak the special grimness and disorder of a fratricidal civil war.

In Goya's *Disasters*, clusters of scenes dominated by active violence alternate with sequences of heaped-up devastation: scenes of the dead and wounded, bodies being stripped, corpses being buried. For Francis Klingender, "the sequences of passive agony are overwhelming precisely because of the monotonous repetition of a single theme."<sup>48</sup> Passages of spontaneous violence give way to the formal violence of retributive executions and mutilations and then, in a wider sweep, to those other familiars of a saturated climate of war: fire, panic and flight, hunger and disease. The war produced a devastating outbreak of typhus in besieged Saragossa and a famine especially severe in Madrid. Their victims appear throughout the later portion of the *Disasters*, prior to the concluding run of *caprichos enfáticos*. Stretching through seventeen scenes (nos. 48–64), the famine sequence forms the longest segment with an iterated common theme, variations on the helpless suffering and dying of especially the poor, the young, and the old. Scenes from earlier sequences of the heaped dead in the wake of conflict (nos. 22 and 23) and the pit burial of stripped corpses (no. 27) have their counterparts here under such titles as (no. 63) *Muertos recogidos* ("Collected dead") and (no. 64) *Carretadas al cementerio* ("Cartloads for the

cemetery”) as well as the more symbolic (no. 62) *Las camas de la muerte* (“The deathbeds”). The famine sequence includes acts of charity to the starving, but with comments that underline their inadequacy. It also includes scenes that underline the fragmentation of civil society in such circumstances, as in no. 61 ([fig. 5.25](#)), *Si son de otro linage* (“Perhaps they are of another breed”), and the sequence ends bitterly with images that mean to convey the dehumanizing effects of death in the mass.



FIGURE 5.21. Francisco de Goya, *Lo mismo* (The same). Etching, lavis, drypoint, burin, and burnisher, from *The Disasters of War* 3.

Source: Yale University Art Gallery, Arthur Ross Collection.



FIGURE 5.22. Francisco de Goya, *Y son fieras* (They are proud). Etching, burnished aquatint, and drypoint, from *The Disasters of War* 5.

Source: Yale University Art Gallery, Arthur Ross Collection.





FIGURE 5.23. Francisco de Goya, No quieren (They don't want to). Etching, burnished aquatint, drypoint, burin, and burnisher, from The Disasters of War 9.

Source: Yale University Art Gallery, Arthur Ross Collection.



FIGURE 5.24. Francisco de Goya, Populacho (Rabble). Etching, lavis, drypoint, burin, and burnisher, from The Disasters of War 28.

Source: Yale University Art Gallery, Arthur Ross Collection.

The impact of the Disasters as a representation of chaos lies in its cumulative effect, its prismatic depiction of war as a condition rather than as a concentrated and conclusive action, and its intimations of a darkness under the masks and disguises of ordinary social life that war brings to light. That Goya drew on a particular war and a particular kind of war gave concreteness to his representation, though he is careful to confine local identification to an allusiveness that preserves the generality of his vision. Though the series makes its effect cumulatively, there are nevertheless single images where chaos appears to be

expressed integrally, even formally, and these deserve particular attention. One such image is among the rape scenes (no. 10). Tampoco (“Likewise”) is a sprawling mound of bodies seen from a low angle, capped by the bent-over figures of two of the soldiers attempting to subdue their victims, one of whom, pitching across the foreground, skirts flying, feet in the air, a soldier’s thick grasping arm dividing her at the waist, seems to bounce off the ground (fig. 5.26). In the left foreground is the foreshortened or contorted head and torso of a fallen figure, at right some discarded weaponry and a busby. A soldier bends over a woman, her hand clutching his hair, another at left seems to be holding apart a pair of legs, one forced in the air, while another leg is thrust out from the heap at right, but it is impossible to untangle and resolve all the body parts into a coherent configuration. It is as if Goya found himself representing an anarchy that destroys the possibility of rational apprehension. Another such scene (no. 30), Estragos de la guerra (“Ravages of war”), is a scene in motion, of implosion into a cellar (fig. 5.27). One of the bodies, that of a woman falling head foremost, appears in midair. She is surrounded by shattered timber, an armchair much out of place, and collapsing brickwork, perhaps a chimney. Beneath her, on the floor, a woman sprawls head down in full frontal display, her infant beside her, as if falling out of the bottom of the picture. Beside them is a confusion of male bodies and a jumble of hands and feet that are not easily assignable. The fragmentation, the inversion, the displacements, and above all the kinesis inform the image with the character of an attempt to catch chaos on the wing. It is chaos precipitated as a single instantaneous event in a confined locale, but like its inclusive title—perhaps a suggestion for that later given to the series—it epitomizes in its extremity the violence of the whole.<sup>49</sup>



FIGURE 5.25. Francisco Goya, *Si son de otro linage* (Perhaps they are of another breed). Etching, lavis, drypoint, burin, and burnisher, from *The Disasters of War* 61.

Source: Yale University Art Gallery, Arthur Ross Collection.

Fragmentation, destruction, exposure, and violation of the human body dominate the most memorable images in the *Disasters*, those that give the series its lingering pressure in

the imagination. Among them are the armless, naked, impaled body of *Esto es peor* (no. 37, “This is worse”); the castration in progress on the naked, spread-eagled body in *Qué hai que hacer mas?* (no. 33, “What more can they do?” [fig. 5.28](#)); the three naked, castrated bodies tied to one broken tree in *Grande hazaña! Con muertos!* (no. 39, “Great exploit! Against the dead!”), one body up, one down, and one with its torso suspended from the knees, its severed arms hanging from the wrists, and its impaled head crowning all ([fig. 5.29](#)). In these last scenes, as Janis Tomlinson notes, the destroyed bodies refer to idealized figures of classical antiquity such as the Belvedere Torso. These marble remains, much studied in the academies, were taken as distillations of rational form as beauty, the very heart of the idea of civilization and order; here in an ultimate violation they are rendered as butchered flesh, mutilated and crucified.<sup>50</sup>



FIGURE 5.26. Francisco de Goya, *Tampoco* (Likewise). Etching and burin, from *The Disasters of War* 10.

Source: Yale University Art Gallery, Arthur Ross Collection.

Among the *caprichos enfáticos* are images that underline the inversion of rational order as emblematic of the prevailing chaos and others, as we have seen, that seek to concretize the horror and unreason as monstrosity.<sup>51</sup> As in the popular tradition, animal imagery in the *Desastres* helps project a world turned upside down. In *Gatesca pantomima* (no. 73, “Feline pantomime”) a monkish figure, congregants in the background, bows before a pedestaled giant cat and a fierce, perhaps attacking, owl. In *Esto es lo peor!* (no. 74, “This is the worst!”), a bearlike creature sits in judgment surrounded by tomes of law and the obsequious and the miserable, led by a kneeling, tonsured friar ([fig. 5.30](#)). At the side stands a ragged prisoner, hands tied and querying heaven, while the wicked-looking animal writes in the ink held out by the churchman, “Wretched humanity, the fault is yours.”<sup>52</sup> In the carnivalesque *Farándula de charlatanes* (no. 75, “Strolling troupe of charlatans”), a kneeling parrot-beaked, vulture-clawed figure performs in ecclesiastical smock while backed by an assemblage of grotesques mixing the humanoid and the bestial. In *El buitre carnívoro* (no. 76, “The carnivorous vulture”), a black griffinlike monster with clipped wings flees before a heroically poised man with a pitchfork and the laughter of the crowd. The failures of the



clergy of all orders—as distinguished from their positive contribution to darkness—are elsewhere represented as an indecisive panic, in an image with the telling title *Todo va revuelto* (no. 42, “Everything is topsy-turvy”) and as desperate flight in its sequel, *Tambien esto* (no. 43, “Same here”), and churchmen are picked out in clerical garb in another scene from the biblical and popular proverbial store that Bruegel also drew upon, illustrating the world given over to folly: a winding procession of respectable male figures roped together at the neck—the blind leading the blind—descend into a trench in the foreground as into the grave (fig. 5.31). The comment is *No saben el camino* (no. 70, “They don’t know the way”). In a very different key, such an image representing war and its victims would resurface in the iconography of World War I, evoked by the convoys of those blinded by that war’s caustic gasses.<sup>53</sup>



FIGURE 5.27. Francisco de Goya, *Estragos de la guerra* (Ravages of war). Etching, drypoint, burin, and burnisher, from *The Disasters of War* 30.

Source: Yale University Art Gallery, University Purchase.



FIGURE 5.28. Francisco de Goya, *Qué hai que hacer mas?* (What more can they do?). Etching, lavis, drypoint, burin, and burnisher, from *The Disasters of War* 33.

Source: Yale University Art Gallery, Arthur Ross Collection.



FIGURE 5.29. Francisco de Goya, *Grande hazaña! con muertos!* (Great exploit! Against the dead!). Etching, lavis, drypoint, burin, and burnisher, from *The Disasters of War* 39.

Source: Digital image © Trustees of the British Museum.

Monstrosity and reversal keep company in some of these images, as they do in *Contra el bien general* (no. 71, “Against the general good”), where a bat-eared, animal-clawed ancient, feet resting on a globe, robed, crowned, enthroned, and worshipped, fills the pages of a heavy book and gestures injunctively. The next print is titled *Las resultas* (no. 72, “The consequences”), and it taps deep into the nightmare. It shows a great vampire, its face grotesquely human, mouth fastened to the torso of a figure, possibly shrouded, possibly sleeping, and ringed by other approaching bat shapes (fig. 5.32). The monstrosity



is not simply in the compound creature but in the cannibalism. The focus of the horror, the creature's mouth where it tugs at the flesh, recalls Rubens's Saturn, the terrible, more literally rendered predecessor of the darkest of Goya's "black" paintings, of Saturn devouring one of his children (1820–1823).

Not surprisingly, there are other intimations in the Desastres of some of the paintings of the early 1820s that project Goya's darkest vision. The cluster of prints showing displacement, panic, and flight, especially *Yo lo vi* (no. 44, "I saw it"), link to the painting called *The Colossus*, or *The Panic*, where what appear to be streams of refugees and their animals flee from an immense naked giant, half turned away, rising over the horizon and through the clouds like a mountainous punitive Mars.<sup>54</sup> The intimations of giant shapes, animal and other, that lurk in the dark background of the prologue plate, "Sad Presentiments of Things to Come," later become concrete as metaphor and monster, but the motif culminates in what Goya intended as the penultimate image (fig. 5.33), *Fiero monstruo!* (no. 81, "Ferocious monster!"). Here the giant anomalous beast, mingling vulpine, bovine, and rodent features, gorges (or perhaps disgorges) a heap of naked human bodies, an image, at once transgressive and perverse, of the chaotic horror stalking humanity in this dreadful time.



FIGURE 5.30. Francisco de Goya, *Esto es lo peor!* (This is the worst!). Etching and burnisher, from *The Disasters of War* 74.

Source: Yale University Art Gallery, Arthur Ross Collection.



FIGURE 5.31. Francisco de Goya, No saben el camino (They don't know the way). Etching, drypoint, burin, and burnisher, from The Disasters of War 70.

Source: Yale University Art Gallery, Arthur Ross Collection.

The Disasters of War as posthumously published ended with the death and interment (no. 79) of Truth and the alarming possibility (alarming to a shadowy ring of monks and monsters) of her resurrection (no. 80). Undoubtedly truth for Goya meant a real knowledge of what is and what ought to be attainable through reason and not an epistemological or cultural imposition on meaningless phenomena. But the knowledge brought by experience had revealed something else, something exceeding the categorical limits of a universe subject to mind: the limits of the rational imagination. In The Disasters of War, the satirist of those who fostered belief in a world inhabited by demons and monsters and of those who act in spite of reason so as to make monsters of themselves gave way to the visionary recorder of a nightmare universe, where a monstrous chaos was the underlying, primitive reality that the madness and the horrors of the present had revealed.



FIGURE 5.32. Francisco de Goya. *Las resultas* (The consequences). Etching, with light surface tone, from *The Disasters of War* 72.

Source: Yale University Art Gallery, Arthur Ross Collection.



FIGURE 5.33. Francisco de Goya, *Fiero monstruo!* (Ferocious monster!). Etching, drypoint, burin, with light surface tone, from *The Disasters of War* 81.

Source: Digital image © Trustees of the British Museum.

### DIX AND THE CHAOS WITHIN

In the spring of 1915, while still training in a heavy machine gun company, Otto Dix painted an extraordinary Self-Portrait as Mars (fig. 5.34). The painter appears in an exploding futurist composition that resections time and space. Dominating and subsuming the radiating lines of force and the distorted fragments of buildings, bloody teeth, armored death's head,

rearing horse, and battlefield debris is the giant, faceted, immobile face of this new/old war god, and at the focus, above the staring eye and within the expanding arcs of a German artillery helmet, a dark space bursting with metallic stars. There is good evidence that Dix took two books to war: a Bible and a volume of Nietzsche. His Nietzsche survives, and among Dix's underlinings in *Thus Spake Zarathustra* is a ringing passage from the prologue that most commentators agree Dix translated into this astonishing self-portrait. "One must have Chaos within," Nietzsche wrote, "in order to give birth to a dancing star."<sup>55</sup>

In *Self-Portrait as Mars*, the artist (and subject) recognizes war as chaos, a supreme disordering energy, and embraces it as continuous with his own nature. But the Romantic century's leading contribution to chaos theory, its positive recasting of disruptive force as energy of transformation and anarchic disorder as creative ferment, would once again reverse sign for Dix under the intolerable weight of his actual experience of the war. It was a change he expressed, moreover, as a reversal of priority in subject-object relations. If, in the *Self-Portrait as Mars*, the war appeared as an externalization of the force field of the self, an authenticating counterpart of the heroic ferment that gave scope to creativity, the same war in retrospect appeared as an assault on the exposed, unarmored subject, invasive, coercive, and disintegrative. In an interview late in life, Dix explained: "you do not notice, as a young man you do not notice it at all, that it is getting to you inside. For years, for a good ten years, I had these dreams, in which I had to crawl through ruined houses with passageways I could hardly squeeze through. I dreamt continually about rubble and ruins."<sup>56</sup> As an immense mill of attrition, arbitrary and indifferent, the war was external force acting on matter, whether landscape and terrain or the human body, and it was the body, in its functions, fate, and congruence with the self, that was at the core of Dix's major art. When Dix embarked on his monumental series *Der Krieg* in 1923–1924 and looked at some of his predecessors, it was above all the action of force upon flesh that he saw in them. "Goya, Callot, and earlier still, Urs Graf—I asked to be shown prints of theirs in Basel. It was fabulous...how human matter was demoniacally transformed."<sup>57</sup>

In Dix's fifty scenes, divided into five portfolios, the transformation is effected chiefly on the bodies of the soldiery. It is they overwhelmingly who endure the deaths and dismemberments, the miseries and the horrors. In once more making the experience of the soldier central to the experience of the chaos of war, Dix is closer to Callot than to Goya, whose *estragos* put before us the experience of the population at large. In Dix, only five of the fifty scenes can be said to focus on the miseries inflicted on the civilian population. These include two scenes of madness, one (folio 4, no. 5) of a grinning woman with horror-filled eyes offering her breast to the mangled dead child lying before her. The other (folio 3, no. 2), a macabre "Nighttime Encounter with a Madman," shows a boyish, skeletal, jug-eared goblin etched in a dark scrawl of lines at the very forefront of the picture space; immediately behind is a ruined landscape crowned by the wrecked wings of a windmill picked out against the night sky (fig. 5.35). Photo-negative inversion of dark and light, as if from a flare or an explosion, adds to the madness and the effect of a shocking apparition.<sup>58</sup> Of the three other scenes with a focus on civil destruction, one, "Lens Is Bombed" (4, no. 3), shows a biplane swooping down over the street of an already much damaged town, with women and children in flight or fallen in the road; a second, "The Ruins of Langemarck" (3,



no. 5), is a destroyed and unpeopled townscape; and the third, “House Destroyed by Airbombs (Tornai)” (4, no. 9), shows the exposed interior of a building with corpses flung, stripped, and dismembered by the blast (fig. 5.36), a scene clearly related to Goya’s Estragos de la guerra print (fig. 5.27). One further etching involving civilian suffering, even closer to Goya in spirit, showed a soldier raping a struggling nun, but it was excluded from the final portfolio at the instance of Dix’s publisher.<sup>59</sup> Another handful of scenes are set in those rear areas where soldiers are liable to be found—brothels, a canteen, a bright nighttime Brussels street with plump whores on parade and a slouching, horny, front-line soldier watching from the gutter, but the vast majority of scenes are in the battle zone, with its churned, ruined terrain and its earth-dwelling soldier inhabitants, living, dying, and dead. In the war on the Western Front, previous and now familiar conceptualizations of war lost much of that Hobbesian distinction between the concentrated violence of a climactic battle between armies within a brief span and in a delimited locale and a diffused but general condition afflicting the population of an extended region over an indefinite time. John Keegan in his illuminating study *The Face of Battle* points out that “the killing zone,” the range of weapons in place, which had been two hundred yards at Agincourt and half a mile at Waterloo, was “upwards of five miles” on the Somme; that the front, which had been under six thousand yards at Waterloo, was nearer twenty miles on the Somme; and that “the battle,” the officially designated period of engagement that produced over a million casualties, did not end at nightfall but extended over four and a half months.<sup>60</sup> Indeed, the entire Western Front, once it had stabilized, was a linear killing zone that shifted very little, that ran for six hundred miles, and that sustained its endemic violence over something like four years. “After the battle of the Somme the war had its own peculiar impress that distinguished it from all other wars,” or so wrote Ernst Jünger in his autobiographical account of the war from the German side. “For I cannot too often repeat, a battle was no longer an episode that spent itself in blood and fire; it was a condition of things that dug itself in remorselessly week after week and even month after month.”<sup>61</sup>



FIGURE 5.34. Otto Dix, Selbstbildnis als Mars (Self-Portrait as Mars) (1915). Oil paint on canvas.

Source: Städtische Sammlungen Freital. © 2014 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn.



FIGURE 5.35. Otto Dix, *Nächtliche Begegnung mit einem Irrsinnigen* (Nighttime encounter with a madman). Etching, aquatint and drypoint, from *Der Krieg*, folio 3.2 (1924).

Source: Gift of Abby Aldrich Rockefeller, The Museum of Modern Art. Digital image © Museum of Modern Art / Licensed by SCALA / Art Resource, NY. © 2014 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn.



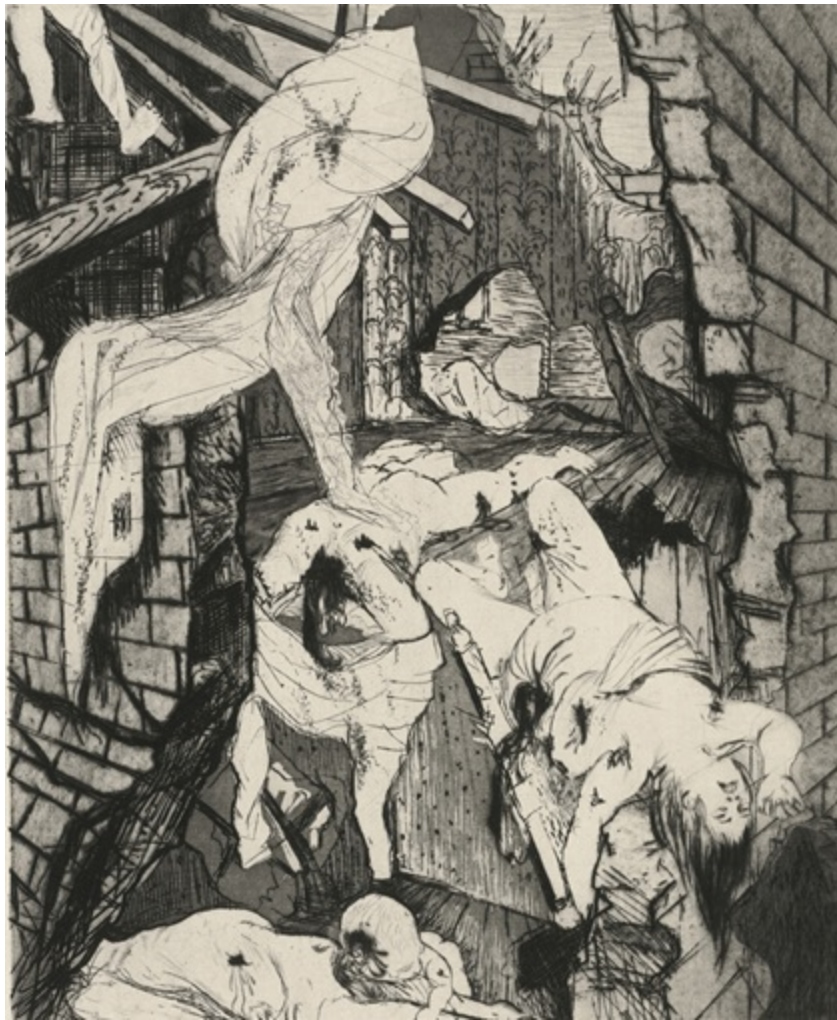


FIGURE 5.36. Otto Dix, *Durch Fliegerbomben zerstörtes Haus (Tornai)* (House destroyed by bombs [Tornai]). Etching, aquatint, and drypoint, from *Der Krieg*, folio 4.9 (1924).

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Dix, who survived the Somme, connects three of his plates with that battle. One shows a machine-gun platoon being brought forward through the mud; a second, exhausted troops being withdrawn; a third, a single wounded soldier in terrified flight. Unlike Callot and Goya, Dix locates more than three-fifths of his images, specifying either place and date (month, season, year, event) or place alone. Another half-dozen are located generically, e.g., as “Between the Lines.” But in fact all the scenes have a generic aspect, even the freakish ones, since here freakish distortion is the norm. The scenes represent what occurs again and again, in endless variation: death, disintegration, wounding of earth and flesh, the obscene mingling of life and death, as a matter of routine. The specificity in the naming serves to assert, as in Goya, “I saw it.” This is what it was like. I was there.

*Der Krieg*, unqualified, is the title Dix gave to his series, and it is striking that, in this representation of war as an all-consuming chaos, combat plays so small a part. Only one scene out of fifty shows a violent encounter (5, no. 4), and that is an assassination: a single soldier raiding in the dark reaches over the lip of a trench to stab a sentry. Only two other scenes show distinctly aggressive action. One is a frontal close-up of “Assault Troops Advancing Under Gas,” the faces of the soldiers fully concealed by their fly-faced gas



masks (2, no. 2), and the second, titled “Sap Trench Posts Must Keep Up Firing at Night” (a phrase with the ring of company orders), looks down on two pot-helmeted soldiers firing into the dark over a churned and agitated perimeter amid crowding bones and bodies and expressive, agonized skulls animated and magnified in the moonlight (5, no. 8; [fig. 5.37](#)).

In Dix’s battle zone, energy even as destructive violence has for the most part expended itself, and the chaos is not in its release but in the entropic residues. The first three prints are titled “Soldier’s Grave Between the Lines,” “Buried Men (January 1916, Champagne),” and “Killed by Gas (Templeux-la-Fosse, August 1916).” The fourth is an empty field of flare-lit craters; the fifth, a dead horse unnaturally on its back, legs stiff, neck stretched, with bare ribs and the hollow of its gut exposed. Other prints early in the series are called “Destroyed Trench” (1, no. 9), “Abandoned Emplacement near Neuville” (2, no. 1), “Abandoned Emplacement near Vis-en-Artois” (2, no. 5), “Resting Company” (2, no. 4). The last shows exhausted troops under a black sky and against a dark earth, sitting, leaning, and lying in full field equipment. One soldier has a head wound; another, his left arm hanging, is an image of total debilitation.



FIGURE 5.37. Otto Dix, *Die Sappenposten haben nachts das Feuer zu unterhalten* (Sap trench posts must keep up firing at night). Etching, aquatint, and drypoint from *Der Krieg*, folio 5.8 (1924).

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Many of the scenes are in effect landscapes, where the churned earth, the torn wire and its supports, corpses, bones, materiel, all the debris of battle, are indiscriminately mingled. In one such scene, “Near Langemarck (February 1918)” (1, no. 7), the bumpy, faded distance with its scattered ruins and uncertain horizon seems little more than an extension of the jumbled, shell-torn foreground where recent corpses and old skeletons keep company ([fig. 5.38](#)). In “Evening on the Witschäte Plain (November 1917)” (3, no. 7), the

flat landscape after battle has become a field of the dead: a receding carpet of contorted bodies is absorbed into the darkening scene reaching from the immediate foreground to compressed bands of light and dark on the horizon. Complementing this view of the battle plain between and beyond the trenches, numbers of scenes look into or out of the ravaged and polluted earth. “Abandoned Emplacement near Neuville” (2, no. 1; [fig. 5.39](#)) shows the wreck of a position from within, a corpse hanging on the wire on the lip to the left, a blasted tree putting out a few leaves center. Another corpse from behind a stump to the right reaches a futile hand toward the leaves. Other bodies inhabit this cloven earth, one as if emerging from a dugout, bottom left, while a leg projects from behind the bank at right. The strongest presence is the wreck of the living tree clinging to life, by virtue of its position and the strength of its etched lines against the pale background, in contrast to the now inert and fragmented corpses. The vital force that continues to put out leaves is the same that sends up the flowers on the crater mound of a shell hole (3, no. 4), in an etching whose sexualized imagery affirms the earth’s violation rather than its serene indifference ([fig. 5.40](#)). The mingling of life and death in imagery that often seems a macabre parody of life is at best ironic, at worst obscene. The transformations, especially of human material, are consistently downward, and the bursts of vitality in entropic decay, however natural, seem shockingly unnatural.<sup>62</sup>

Many of the etchings are premised upon the encounter of the living with the dead, the living either in the scene itself, or in the implied presence of the artist recording what he has seen, or in the putative viewer, engaged and repelled in the act of looking. The dead outnumber the living, and the former sometimes display a vitality the living might envy. “Seen on the Escarpment of Cléry-sur-Somme” (3, no. 8) is the title Dix gives to one macabre rendering of two corpses in apparent conversation ([fig. 5.41](#)). The dead and the dismembered had a large role in Goya’s vision of the chaos of war as well. But in Goya’s scenes, the dead were always still fresh, their mutilations and dismemberments were amputations, and their stripped bodies left on the field, or dumped in the burial pit, or impaled on a tree were still classical in form. Only in the famine scenes do we see bodies moribund and emaciated, between life and death. Otherwise, the living are living, the dead are dead. Dix in contrast dissolves such deep-rooted distinctions and protections. His bodies encompass all stages of the transformation of human matter, all stages of decay and dissolution, from the fresh catastrophic wound to the mummified corpse on the wire, to the piecemeal skeletons turned up in the new-churned earth. Earth mingles with flesh and bone, death mimics life, life colonizes death. In “Dying Soldier” (3, no. 6), the violated, lacerated flesh, gaping exposure, and agonized rictus anticipate the disintegration to come ([fig. 5.42](#)). In “Machine Gun Section Advances (Somme, November 1916)” (5, no. 1), the living soldiers struggle down a slope in which the dead and the mud are nearly indistinguishable, as if one medium ([fig. 5.43](#)). The eight soldiers, carrying the materials of destruction—grenades, ammunition boxes, packs, two machine guns—and some using sticks to help themselves through, are picked out with thickened outlines and shading that sets them off for now from the slurry of mud and corpses in which their feet sink, threatening to draw them in. At least two dozen bodies, or parts of them, are visible, and one soldier at the center, mouth open, eyes straining, body held wide, looks down in horror

and perhaps recognition, of himself or another, at one of the dim faces.



FIGURE 5.38. Otto Dix, *Bei Langemarck (Februar 1918)* (Near Langemarck [February 1918]). Etching and drypoint, from *Der Krieg*, folio 1.7 (1924).

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FIGURE 5.39. Otto Dix, *Verlassene Stellung bei Neuville* (Abandoned emplacement near Neuville). Etching and drypoint, from *Der Krieg*, folio 2.1 (1924).

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FIGURE 5.40. Otto Dix, Granattrichter mit Blumen (Frühling 1916, bei Reims) (Shell crater with flowers [Spring 1916, near Reims]). Etching and drypoint, from *Der Krieg*, folio 3.4 (1924).

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The meeting of the living and the dead takes another direction in “Mealtime in the Trench (Loretto Heights)” (2, no. 3), where the seated soldier, looking directly at the viewer, stuffs his open mouth from a can in company with the remains of a skeleton, whose delicate lines and white spaces, half emerging from an earth that seems spotted with disease, contrast with the vigorous lines and cross-hatchings, dark face, and strongly modeled hands of the soldier (fig. 5.44). The survivor’s animal vigor and imperviousness to his companion’s presence comport with his rakishly set cap and contrast with the blotches and mottlings of the terrain. But it is a brutal vitality that he asserts, like that in the swarming corruption in Dix’s etching of the skull, or in his “Dead Sentry at His Post” (2, no. 8), alive with worms and maggots wherever the body shows through the rotten cloth.

The chaos of war in Dix’s vision is above all physical. It is matter disorganized and displaced or matter transformed into a formless seething, matter losing distinction. The patterns it creates are accidental or imposed—like that in the lined-up corpses in “Killed by Gas (Templeux-la-Fosse, August 1916)” (1, no. 3) or that induced by the nighttime lighting in “Crater Field near Dontrien Lit by Flares” (1, no. 4). But the material chaos has its counterpart in the psychological realm, in the extremities of madness and terror, as in Dix’s “Wounded Man (Autumn 1916, Bapaume)” (1, no. 6). An image of purest fright, the soldier lies diagonally across the scene, clutching himself with one hand, the other reaching out nervelessly from a shattered arm (fig. 5.45). The strap of his slipped helmet lies foolishly across the bridge of his nose. The blotched and spotted background seems already to be assimilating part of his body. Here the etching and aquatint process is used not only to create the wounds and register the body’s disintegration but to convey the ultimate terror of annihilation. Nietzsche had said one must have chaos within to give birth to a dancing star. Here is chaos within, fully expressed. But it is chaos that was thrust on the subject, the invasion of chaos, giving birth to nothing but its detritus, as in the wasteland perception that pervades so much significant literature and art in the decade after the war. Dix’s etching seeks out an affective truth, one vivid enough to make reflection otiose. It is not emotion recollected in tranquility. Here the war has been taken in, the chaos stripped of its patterning accidents, and it cannot be contained even in the image. The body’s deformation by force of explosion and the mind’s by the terror of annihilating dissolution are one in a projection of what neither mind nor body can compass or transcend. It is that chaos of the inner/outer world that Dix’s unstructured representation seeks to illustrate, a condition and a consciousness that obtained across a thick seam of Europe between 1914 and 1918, that he calls *The War*.



FIGURE 5.41. Otto Dix, *Gesehen am Steilhang von Cléry-sur-Somme* (Seen on the escarpment of Cléry-sur-Somme). Etching, aquatint, and drypoint, from *Der Krieg*, folio 3.8. (1924).

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FIGURE 5.42. Otto Dix, *Sterbender Soldat* (Dying soldier). Etching, aquatint, and drypoint, from *Der Krieg*, folio 3.6 (1924).

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FIGURE 5.43. Otto Dix, Maschinengewehrzug geht vor (Somme, November 1916) (Machine-gun section advances [Somme, November 1916]). Etching and aquatint, from *Der Krieg*, folio 5.1 (1924).

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FIGURE 5.44. Otto Dix, Mahlzeit in der Sappe (Lorettohöhe) (Mealtime in the trench [Loretto Heights]). Etching and drypoint, from *Der Krieg*, folio 2.3 (1924).

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FIGURE 5.45. Otto Dix, Verwundete (Herbst 1916, Bapaume) (Wounded Man [Autumn 1916, Bapaume]). Etching and aquatint, from *Der Krieg*, folio 1.6. (1924).

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## CONSUMMATION



War as a scene of battle, focused and intense, is easier to imagine than war as a constant condition, but what historians generally favor with the name of battle is something more than a spasm of uncontrolled turmoil. Distributed small-scale fighting and even the odd battle fit readily into the general climate of violence and unpredictability illustrated in Callot's and Goya's representations. But as John Keegan points out, there is a "fundamental difference between the sort of sporadic, small scale fighting which is the small change of soldiering and the sort we characterize as a battle. A battle must obey the dramatic unities of time, place and action"—even if the drama proper need no longer do so.<sup>63</sup> Nevertheless, in the world of Dix's *Der Krieg*, it is clear that "battle" has lost such claim as it had to a unity of time, place, and action. Like that shambles named after the river Somme, it lasts too long and spreads too wide, dissolves into episodes reabsorbed in a sustained background, and while it may grind to a halt, it very likely reaches no definitive resolution. As in Jünger's description, it has become once again "a condition of things."

## MANAGING THE CHAOS

Though many great battles in the classic mold have in fact been inconclusive, the dramatic ideal of battle requires not only that it have a climax but that it have a climactic role within the larger drama of the war, as the result of strategic design, fatal circumstance, tactical brilliance, of discernable chains of causation that eventuate in Pharsalia or Lepanto or Sedan or Stalingrad or Dien Bien Phu and decide the future. That battle be "decisive" and therefore historically meaningful as well as aesthetically satisfying is an ideal standard not of recent invention but made normative, Keegan suggests, for modern military historians, as late as the nineteenth century.<sup>64</sup> Dramatic form and decisive importance are the attributes that a battle worthy of the name seems to require. But in addition to those aids to constructive appreciation, battle is subject to another ordering demand, this one professional. It stands as the culminating application of whatever can be called the art or science of war. In practice that means less a mastery of creative surprise and invention than mastering the reduction of the boundless possibilities of the field to a manageable few. If battle is the privileged genre in the art of war, as epic and tragedy were in poetry, its preparation includes the creation of armies, whereby individuals are bundled into corporate units, dress and arms are (within limits) standardized, the possibilities of action in the field (especially during what has been called "The Age of Battles") reduced to a manual of motions and maneuvers. To simplify things further, initial dispositions, intelligence, and even a battle plan seek to eliminate whole ranges of combinatorial possibilities and results. Keegan mentions a short story written before World War I by a general, Sir Edward Swinton, and possibly based on a Moltke anecdote, wherein the commander-protagonist, having made all his dispositions on the eve of battle, goes fishing while the battle plays out (201). Something of the same spirit, Keegan suggests, was to be found in the British planning for the attack on the Somme, "a spirit not of providing for eventualities, but rather of attempting to preordain the future." He then further criticizes measures to forestall some eventualities that increased the "complication of a plan which would depend for its success

on the smooth interaction of a very large number of mutually dependent elements” (261).

Simplification, an instrument for controlling the potential chaos of battle, breaks down because, as on the Somme, the ambition to manage and reduce the unpredictability of battle itself generates complexity. It predictably fails, given the stubborn independence of the enemy’s own dispositions and the mutual ambition to “carry disorder and confusion into the enemy’s ranks.”<sup>65</sup> Armies are organized to effect that purpose and stave off such disruption to themselves. But as Keegan observes:

Inside every army is a crowd struggling to get out, and the strongest fear with which every commander lives—stronger than his fear of defeat and even of mutiny—is that of his army reverting to a crowd through some error of his making. For a crowd is the antithesis of an army, a human assembly animated not by discipline but by mood, by the play of inconstant and potentially infectious emotion which, if it spreads, is fatal to an army’s subordination.

(173)

Mass armies moving as hordes, like those rallying to the defense of the nascent French Republic, fashioning themselves into “human waves,” or even dispersing into randomly acting guerilla forces, are not to be equated with an army transformed into a mob in the crucible of battle or in the enthusiasm of uncontrolled rapine and plunder. All the great literary representations of the chaos of battle do not stop with the fury of the encounter but rely on depicting a debacle as its disastrous concomitant. So in Stendhal’s *The Charterhouse of Parma*, Fabrice del Dongo is caught in the French army’s mob-retreat from Waterloo. In *The Red Badge of Courage*, Crane immerses his young hero in what seems to be a universal panic behind the lines. In *War and Peace*, Tolstoy represents the disintegration of the allied forces at Austerlitz, a bedlam of disorganized, mingling, and jostling crowds, choking roads and bridges, a mass contributing to its own destruction. Later, in the context of Borodino, Tolstoy describes the flux of engagement in battle as an alternation of army and crowd states. As the troops leave “the place where the balls and bullets were flying about,” their officers “re-formed them and brought them under discipline, and under the influence of that discipline led them back to the zone of fire, where under the influence of fear of death they lost their discipline and rushed about according to the chance promptings of the throng” (book 10, chap. 33). Disaster to the French army arrives, however, not here, or still later on the Beresina, but in the city of Moscow, where “a weary and famished, but still a fighting and menacing army,” still “in good marching order,” when dispersed through the city, turns into an uncontrollable and irredeemable “mob of marauders” (book 11, chap. 26). In the subsequent great retreat, they are an “enormous mass” bound together as if by gravitation and an inertial trajectory—but they are not an army (book 13, chap. 19).

Even discounting the unpredictability of the enemy and the war machine’s intrinsic mission to create chaos, simplification fails where the sheer scale of the event increases the complexity of transport, supply, terrain, communication, weaponry, and the number and variety of men and military units. Since on a fine scale the number of contributing factors and their possible combinations in any sizable battle are incalculable, the attempt to keep cognitive control is subject to the very same form of collapse that produces the chaos of number. Those directly engaged with managing forces attempt to cope though a

hierarchical division of labor and selective attention. But for those subsequently engaged with representation, it is only by constructing “the larger picture,” the battle as drastically abstracted, rationalized, and informed with retrospective significance, that one can hope to override—that is, contain—the ambient chaos. Accordingly, the most convincing representations of the experience of battle and of the chaos realized in battle have finessed the larger picture, have been fragmentary and phenomenalist, and have rendered sensation and perception through a single experiencing mind and sensibility.<sup>66</sup> What Keegan has allusively called “the cloud of unknowing” blanketing the World War I battlefield at zero hour no doubt descends on the would-be masters of the action, but it finds its most compelling expression in the single consciousness suffering and witnessing the maelstrom in its own fractal sector. Yet few besides Tolstoy have argued from this experiential reality to a rejection of the validity of hierarchical selection, reductive abstraction, and a comprehensive overview in both historical narrative and application of the “art” or “science” of war.<sup>67</sup>

## THE FOG OF BATTLE

Through its gift for rendering the intimacy of experience, for mediating experience through subjective presence, and for creating analytical distances in and between sensation, perception, and cognition, literature has the advantage over picture for rendering the chaos of battle. Great battle paintings exist: the genre of battle paintings is if anything overpopulated. But if one eliminates the paintings with explanatory topographic or strategic programs and those designed to glorify the calm mastery, the heroic presence, or the godlike demise of a leader, what remains is attracted to one of two poles. On the one hand, the battle becomes a melee, an episode of pure combat; on the other, it offers a distant panorama, sometimes qualified into an apocalypse. Altdorfer’s great Battle of Issus (1529), for example—representing Alexander’s victory and part of a cycle of classical battles painted for the king of Bavaria—sublimates the effect of distance by informing panorama with an apocalyptic aspect, a parallel between events on the field and the whole vast drama of earth and sky. At the other extreme is a distilled form of skirmish that even in its fragmentariness seeks to evoke the heart of battle and reunites conflict with chaos, where the collisions of men and horses, intensifications of pure combat, convey unqualified turmoil and passion, whatever the historical event invoked in the name. The wish to render the essential energy of conflict, energy that both gives expression to form and challenges the limits of its articulation and coherence, can make of armor, dress, formations, materiel, the signifiers of time and place, little more than encumbrances, reason enough for the unencumbered and essentializing nude battle scene.<sup>68</sup> But clothed and historicized or not, from Leonardo’s unfinished Battle of Anghiari, to Rubens’s Leonardo-derived Battle for the Standard, Battle of the Amazons, and Death of the Consul Decius Mus battle cartoon, to Gros’s Battle of Aboukir celebrating Murat, the rush and entanglement of bodies at the heart of battle evoked chaos as a heroic melee, a struggling knot of men and animals seen close enough to display the bodily lineaments of an agon and to mark the terror and murder

in the eye of the agonists.

Nevertheless, the representation that most successfully conveys the chaos of battle to the modern sensibility is one that gives scope to a subjective presence, can seemingly erase the line between inner and outer experience, yet registers the abyss between an ungraspable externality and an immersed, groping consciousness. And for that one turns to the inwardness of literature. The abyss is the wellspring of the unsparing irony with which Stendhal frames his representation, and Fabrizio del Dongo's experience, of Waterloo in *The Charterhouse of Parma* (1839).<sup>69</sup> As a passionate seventeen-year-old, a believer in the French cause and the ideal of heroism, Fabrizio has made his way to the site of what, for most Europeans in the nineteenth century, was the supremely decisive, supremely dramatic battle of the age. Let loose on the eve of Waterloo, armed and uniformed, Fabrizio wanders the field, attaches himself for a spell to Ney's escort, comes under fire, shoots down a Prussian cavalryman and escapes being sabered, joins the retreat, and is wounded by other fugitives when posted in the way of their flight. His immersion is marked by the confusion of his sensations and the fragmentariness and opacity of what he experiences. When the surface of a soaked field begins "moving in a singular fashion," the ridges flying off in little lumps, Fabrizio notices "this curious effect." It is only when some neighboring hussars fall and he sees a bloody horse struggling on the ploughed land, "hooves caught in its own entrails," that the light dawns: "'Ah! So I am under fire at last!' he said to himself. 'I have seen shots fired!'" (1:54). But discerning smoke from a far battery while seeming to hear shots closer at hand amid the continuous rumble, he "could not understand in the least what was happening." Moving along a sunken road with Ney's escort, he sees "widely extended lines of men in red," seeming, surprisingly, "quite minute," then a line of red cavalry trotting forward. Smoke makes it impossible to distinguish anything in the direction they are going. Riders dash up and speak to the marshal, a general gallops off toward the enemy, and Fabrizio asks a friendly sergeant, "Sir...is this a real battle?" (1:55). He sees a cuirassier's leg being sawed off, takes too much brandy at a cantinière's, and when the emperor goes by and the escort shouts, Fabrizio stares but cannot make him out among the generals and dragoons. Hearing "an odd little sound quite close to him," he notices four men down and a general covered with blood and unhorsed, whereupon Fabrizio's mount is commandeered and he is left in a rage on his own (1:59–60). He manages to attach himself to a body of infantry but then sleeps through a Prussian attack in a cantinière's cart and wakes in the midst of the débâcle. Taken on by a corporal keeping a shard of the regiment together, he finds himself in a skirmish at last. He becomes part of the retreat, with its choked roads, total disorganization and indiscipline, and wild rumors. On the following day, having been sent off on his own, "What distressed him most was that he had not asked Corporal Aubry the question: 'Have I really taken part in a battle?'" though it seemed to him that he had (1:77). Later, when recovering from his post-battle wounds, he reflects on all that has happened to him, feeling a changed man. But "he had remained a child on one point only: what he had seen, was it a battle; and, if so, was that battle Waterloo?" (1:91). And, in a foretaste of how history is made and a coherent reality constructed from the fractured multiplicity and experiential chaos of battle, he avidly reads the newspapers and the published recits de bataille, seeking descriptions that would help him fix and identify the



places he had been.<sup>70</sup>

The cognitive and ultimately philosophical irony conveyed through Fabrizio's experience of a world-historical event is on the face of it more ambitious than the irony that frames the battle in Stephen Crane's *Red Badge of Courage* (1895). Crane's irony is mostly directed at the delusive impositions of the heroic ideal, obliterated in the tidal flux of his youthful protagonist's action. However, it is not the cognitive gap between the actual events and the experiencing consciousness that here contains the primary truth of battle, as one might anticipate after Stendhal, but rather, whatever truth there is lies in the experience itself, collective in many of its impulses but subjective in the final analysis. The true nature of battle in Crane's imaginative retelling is in the felt reality of what the mind takes in. Perception and emotion are not analytically distinct, and there is no totality, coherent in itself and superior to the single experiencing consciousness, against which the experience can be measured or falsified. There are only other perceivers, whose knowledge can have no special purchase when it is brought to bear on the experience of anyone else.

Not only was it Crane's aim "to see war from within," but in contrast to Stendhal, "it was essential that I should make my battle a type and name no names"—essential, that is, to avoid setting his protagonist's direct experience against a preformed dramatic narrative retrospectively articulated.<sup>71</sup> The reality of battle is not to be referred to its formal components nor to its position and weight in a larger drama. Crane's protagonist—mostly called "the youth" in the narrative, though occasionally named by his companions—can scarcely believe his imminent mingling in "one of those great affairs of the earth" recognized as such by the newspapers, which, almost every day, "printed accounts of a decisive victory." As if such sidelong irony were not enough, Crane enters a disclaimer for both the formal and historical significance of his narrated events in the very subtitle of the novel: "An Episode of the American Civil War." The experience is meaningful for the protagonist, however, in the most obvious way, as a rite of passage. It is meaningful in its arbitrariness, marked by anticlimax, and as a passage through inner and outer chaos.

Though like Stendhal Crane takes as his perceiving consciousness a novice in battle whom he soon relieves of his naive expectations, this approach to a *tabula rasa* does not produce a purely phenomenalist account nor a purely affective one. Rather, the youth's experience of battle is an inseparable amalgam of feeling and perception, fluctuating both in intensity and inwardness. And while nearly all that informs the reader comes through the sensibility of the youth and his purview, it is an enlarged purview rather than a rigid sensory envelope confined to six feet of immediacy. It takes advantage of the youth's panicked flight and roundabout return, overheard conversations at the divisional level, elevated prospects and glimpses of other parts of the battle terrain, to convey larger pieces of the scene and action, including tactical intentions. Stylistically, Crane's representation of the youth's perceiving consciousness through indirect discourse allows some interpretive space between interiority and events. The language and imagery by which feeling and perception are conveyed also convey the tension between collective experience and the singularity of a particular consciousness. That tension plays out within the implicit framework that recognizes battle as, simultaneously, an effort to contain chaos and to encourage it.

In Crane's rendering, the chaos of battle lies necessarily in the experience of the

perceiver, but how the mind deals with the inchoate, with disjunction and overload, depends on the strength of those feelings of collective identity. In the single perceiver conscious of his singleness, the chaos is fully present; in the member of a cohering collective, the chaos is pushed to the periphery. The coherence of armies lies in their nested collective identities, and the energies of battle are directed to disrupting these, to reducing the parts to particles. Crane links his psychological realism and subjectivism with these dynamics, initially by way of metaphor.

In his opening paragraph, before narrowing focus and lowering viewpoint, Crane treats the encamped army as a single animate creature that “awakened and began to tremble with eagerness at the noise of rumors” and that “cast its eyes upon the roads.” Later, a regiment on the march in the dark, though rendered in synecdoche as creak and rustle, the feel of the air and glimmers of steel, is likened to “one of those moving monsters wending with many feet...huge crawling reptiles.” In the dawn, the long black columns appear “like two serpents crawling from the cavern of night.” Still later, brought into his first action with his unit after much inexplicable and alarming waiting, marching, and maneuvering, the youth finds himself hard at work loading and firing his piece and becomes “not a man but a member.” Then, in the heat of the action, the rendered experience grows especially intimate, limited, and fragmentary. The youth’s thoughts “go careering off,” his actions become automatic. He is conscious of “a blistering sweat, a sensation that his eyeballs were about to crack like hot stones. A burning roar filled his ears.” Then comes “a red rage” likened to “the acute exasperation of a pestered animal.” Nevertheless, he remains consciously linked to his comrades about him, though only when the firing abates does he become again aware of the immediate surroundings and the wider scene (35–38).

In the central episode of the novel, the youth panics, partly through contagion, and from someone belonging to a group and a regiment, he becomes a particle, moving freely, a singular point of consciousness and experience. He rationalizes his flight as that of “a little piece of the army,” whose duty was “to rescue itself if possible. Later, the officers could fit the little pieces together again and make a battle-front” (45). His personal retreat separates him from collective identity and action but drives him to seek out the reality of battle, first in its panoramic display (barely intelligible as “long gray walls of vapor” and massive sound), then in its essence as mechanical monstrosity: “The battle was like the grinding of an immense and terrible machine to him.... He must go close and see it produce corpses” (50). What he sees and hears in this phase of motion are the varieties of disorder that flow from the churn of battle and that its machinery is geared to produce: streams of the torn and wounded, a “heaving tangle” on the roadway turned into “a crying mass of wagons, teams and men.” The culminating disorder comes as a column of infantry that has pressed calmly through the mass toward “the heart of the din” returns “in dark waves of men...sweeping out of the woods...bursting from their coats and their equipments,” charging down upon the youth “like terrified buffaloes,” leaping and scampering all about him, gabbling insanely, running hither and thither as the artillery, booming on all sides, “made jumble of ideas of direction.” From their mouths came “a thousand wild questions but no one made answers” (69–70). Like Fabrizio in the retreat, it is from one of these that the youth receives his validating wound, his “red badge of courage.”

Struck in the head, the youth's perceptions become even more tentative and fragmentary: the grumble and scurry of horse-drawn cannon, altercations, the roar and peal of gunfire, sheets of light, and now and then heaving masses of men. In the fields and woods, in darkness, "There seemed to be a great ruck of men and munitions," a one-time stream "choked with the bodies of horses and splintered parts of war machines" (70–71). It is battle experienced as shards and fragments, as unintelligible nightmare and phantasmagoria. From the moment of the youth's flight, he has lost any point of reference, while through flight and destruction companies, regiments, and armies have lost their coherent identities and devolved into randomly acting individuals and masses or into wounded, dying, and dead. When by a lucky chance the youth makes his way back to his still intact company, it is to reassume some measure of its collective identity—strongest in the heat of engagement—and a degree of cognitive focus, though not much more sense of a comprehensive intelligibility.

The chaos of battle for Henry Fleming (the name by which the youth is known to his fellow soldiers) derives not only from obscurity and fragmentation, from sensory and cognitive deprivation, but from sensory overload as well, the two being sometimes hard to separate. Though Henry's battle, and ours, is all in the detail, which is discontinuous and often made strange with a result that might be thought phenomenistic, the percepts are laden with affective interpretation, less from the grasping after meaning than through its unbidden intrusion. So, in Henry's awakening the morning after his return to the regiment, "The distance was splintering and blaring with the noise of fighting. There was in the sound, an expression of deadly persistency as if it had not begun and was not to cease" (80). The noise is characterized by quality and origin but also by the feelings it evokes, of threat and inescapability, which are laid on the sound and made its attributes. (In the same early light he sees a mass of sprawled sleepers that he takes for a field of the dead and then, adjusting, "saw this sombre picture was not a fact of the present, but a mere prophecy.") Later, on the line, as the guns are further "aroused and enraged," the "battle roar settled to a rolling thunder which was a single, long explosion" (93). Still later, after a relative lull, the sound swells to "an interminable roar.... To those in the midst of it, it became a din fitted to the universe. It was the whirring and thumping of gigantic machinery, complications among the smaller stars. The youth's ears were filled cups. They were incapable of hearing more" (123).

The scale calls for hyperbole—and hyperbole fails, as do the saturated senses. When the experience is most intense, in the assault, the focal distance is shortest, and perception is sharpest ("Each blade of the green grass was bold and clear," 105). But it is also least reliable ("His eye-sight was shaken and dazzled by the tension of thought and muscle. He did not see anything excepting the mist of smoke gashed by the little knives of fire but he knew that in it lay the aged fence," 128). Perceptual and emotional overload brings on automatism. At one point the youth is unconscious that he is on his feet and of the direction of the ground. Having fallen, he is up immediately, and "One thought went through the chaos of his brain at the time. He wondered if he had fallen because he had been shot" (95–96). Intent and oblivious, he keeps firing when there is no one to shoot at (and is consequently looked upon as a "war-devil"). A final, successful charge, as the regiment approaches

exhaustion, is “like a paroxysm,” a surge of collective reflex rendered in the perceived rush and swirl of kaleidoscopic motion. When it is over, and the roaring fades and the regiment is marched away, it is not known whether the battle has been a defeat or a victory. But it is past, the chaos now, for Henry, “a sultry night-mare,” and he can look forward to the resumption of the orderly world of nature and of peace.

The question of the result, of who has won the victory, is equally problematic for the participants in the greatest of Tolstoy’s battle representations, the Battle of Borodino in *War and Peace*. At the end of the day, both armies are exhausted but still in the field, the Russians blocking the French advance. Napoleon has lost a quarter of his army and gained some positions; the Russians, says Tolstoy, have lost half of theirs. Kutuzov, the supreme Russian commander whom Tolstoy reinvents for posterity, has issued orders for an attack the next morning to counter the view that the battle has been lost. Meanwhile, Napoleon is characterized as recognizing that he has been dealt a mortal blow; nevertheless, on the next day he finds himself master of an abandoned field and able to continue his advance to Moscow. Despite the Russian withdrawal, Tolstoy claims the outcome is a Russian moral victory, not as the loser’s conventional consolation but as an assertion of will and spirit that ultimately demoralizes the enemy and guarantees his defeat.

Tolstoy thus argues for the uncertainty of the battle, its indecisiveness as a broken-off action, but its decisive influence on what follows. The cloud of unknowing, so thick that even Napoleon is lost in it, is not dispelled when the fighting stops, but the intrinsic, inevitable confusion of battle doesn’t prevent it from functioning as a “turning point” after all, in how it participates in the vaster drama of inexplicable historical forces. Tolstoy writes (having recourse, as often, to the language of mechanics), that after the battle the French army rolls forward to Moscow, impelled by some residue of momentum, but there, and with no further Russian effort,

it had to perish, bleeding from the mortal wound it had received at Borodínó. The direct consequence of the Battle of Borodínó was Napoleon’s senseless flight from Moscow, his retreat along the old Smolénsk road, the destruction of the invading army of five hundred thousand men, and the downfall of Napoleonic France, on which at Borodínó for the first time the hand of an opponent of stronger spirit had been laid.

(book 10, chap. 39)

Within the sweep of this supreme historical fiction, Borodino plays a similar pivotal role, determining the course of lives while capping a series of formal battle descriptions. Tolstoy passes his battle narratives through a number of experiencing minds, notably of Nikolai Rostov, a novice warrior at Schön Grabern and Austerlitz; Prince Andrei Bolkonsky, a professional soldier and man of deep intellect and sensibility; and Pierre Bezuhov, a civilian licensed to risk his neck at Borodino by his fortune and his eccentricity. In these battles, Tolstoy readily shifts between points of view—he even peers through Napoleon’s eyes and mind—and slips out of these registers into external narration when it suits him. The shifts between experiencing subjects and Tolstoyan interventions suggest both the possibility of an emergent comprehensive picture and the fragmentary and disjunctive qualities of experience. Meanwhile Tolstoy expounds the nature of battle as a universe of particulars that eludes comprehension and totalizing generalization.



Pierre, however, is the primary center of experience at Borodino, his naiveté and openness complementing Napoleon's histrionic egotism and Andrei's disillusioned acceptance. Isaiah Berlin writes of Pierre in his classic essay on Tolstoy, *The Hedgehog and the Fox*, that he is seeking

a battle as depicted by the historians and the painters. But he finds only the ordinary confusion of individual human beings haphazardly attending to this or that human want.... Pierre sees only a succession of "accidents" whose origins and consequences are, by and large, untraceable and unpredictable; only loosely strung groups of events forming an ever varying pattern, following no discernible order.<sup>72</sup>

When, on the morning of the action, Pierre, looking out on a panorama filled with troops and smoke, descends into the scene before him, he has no idea "despite the incessant firing.... that this was the field of battle." When he ascends a knoll crowned with a battery that the French regard as the key to the whole Russian position, he has no notion that this spot, lightly entrenched and with a few guns firing, "was the most important point of the battle. On the contrary, just because he happened to be there he thought it one of the least significant parts of the field" (book 10, chap. 31). His bemusement is close to Fabrizio's at some points, and indeed, Tolstoy declared his great debt to Stendhal for his understanding of war "as it really is" and cites in particular Fabrizio's bewildered passage through the Battle of Waterloo.<sup>73</sup> Crane in his turn owed a great deal to Sebastapol, Tolstoy's account of war in the Crimea.<sup>74</sup> But while Crane and Tolstoy share an approach that conveys the chaos of battle as its reality, they part company on the need to look beyond the chaos.

Berlin's essay unfolds the paradox not only in Tolstoy's idea of history but in his nature, which insists on the cognitive chaos that pervades action and experience and on an intrinsic order, deterministic and comprehensive, but so multitudinously constituted as to be outside the possibility of apprehension by human actors. Experience, Tolstoy insists, must not be falsified, for it is what we know. It follows that, despite the human aptitude for self-delusion (especially among historians), including the "presumptuous nonsense...to claim to perceive an order merely on the strength of believing desperately that an order must exist...[yet] all one actually perceives is meaningless chaos—a chaos of which the heightened form, the microcosm in which the disorder of human life is reflected in an intense degree, is war."<sup>75</sup> For Crane, it is enough "to see from within" to represent the true chaos of battle; for Tolstoy, the prospect is vexed by what is there but cannot be seen.

The problem essentially is one of number and scale. First, the disjunction between the nature of the event and any circumstantial explanation makes it incomprehensible. "We cannot grasp what connection such circumstances have with the actual fact of slaughter and violence." And then there is the disproportion. As one confronts the "incalculable number of causes," each cause and each series appears equally valid, equally significant, and equally inadequate (book 9, chap. 1). When the battle is joined, the multitude of causes, actions, agents, beyond reckoning and beyond comprehending, make it impossible to predict its course or to plan beforehand according to a "science" of war or a set of military principles. Equally, it makes the notion of presiding over the conflict and determining its outcome, that is, the idea of a military genius and master spirit of the field, absurd. "A battle is won by those who firmly resolve to win it!" says Andrey to Pierre shortly before Borodino. "But what

awaits us to-morrow? A hundred million, most diverse chances which will be decided on the instant by the fact that our men or theirs run or do not run, and that this man or that man is killed” (book 10, chap. 25). For emphasis, Tolstoy has Clausewitz and Wolzogen ride up at this point and exchange solemn German generalizations.

So many and so local are the chances, so dependent is the outcome on the myriad dispositions and actions of those engaged and “innumerable conflicts of various wills” (book 10, chap. 7), that Tolstoy proposes a law of inverse proportionality between the influence of the agent on the battle and his rank or command function. The further up the line, the less direct one’s engagement—and thus, with respect to the outcome, the less important what one does. Similarly, the further from the action, the less one really knows. The best generals act wise and give encouragement but can do little more than make the best of things as they occur (when it is too late to do anything much). The result is a great leveling, a declaration that battle is intrinsically hostile to the structures and hierarchies whereby armies control multiplicity and organize toward a common goal. Ostensibly seeking to characterize power, Tolstoy likens an army to a cone, “of which the base with the largest diameter consists of the rank and file...the point of which will represent the commander-in-chief” (epilogue 2, chap. 6). From the base, where “the soldier himself does the stabbing, hacking, burning, and pillaging,” through all degrees to the apex of pure command, direct agency and the function of command are complementary reciprocals, more of the one meaning less of the other. But the functions of command, like the justificatory explanations, before and after, for grand collective actions such as wars and revolutions, Tolstoy likens to the bow wave of a ship under way, “leading” in whatever direction the ship happens to go (epilogue 2, chap. 7). It was through similar reasoning that Andrey, replying to the tsar, asks to serve with the soldiers in the field during the invasion. He has concluded, “The success of a military action depends not on them [the military geniuses giving the orders], but on the man in the ranks who shouts ‘We are lost!’ or who shouts ‘Hurrah!’ And only in the ranks can one serve with the assurance of being useful” (book 9, chap. 11).<sup>76</sup>

The chaos actualized in battle is made inevitable by the unpredictability of an enemy whose organized energies are directed at creating chaos, by the condition of ignorance afflicting the participants at all levels, and by the multitudinousness of factors and events. Tolstoy, like other novelists and memoirists evoking gunpowder battles, wraps the climate of ignorance in the obscuring smoke and ferocious din of the encounter. Moreover, the dispositions at Austerlitz and Borodino extended over many square miles. Communication had to be by mounted messenger, meaning that reports of conditions and strategic commands were likely to be irrelevant or worse by the time of receipt. Tolstoy shows Prince Bagration, commanding on one of the Russian flanks the morning of Austerlitz, deliberately sending a messenger (Rostov) to have an order confirmed in the knowledge that, in the unlikely event the messenger survived, the battle would be over by the time he returned (book 3, chap. 17). The happy result for the narrative is that Rostov, riding from flank to flank, has a wider exposure to the battle than a soldier fighting in his position or sector or a commander surveying the scene from a safe elevation. But Rostov’s exposure is to a series of fragments, skirting charges whose result he cannot know, on the edge of firefights, through artillery killing fields and milling, disorganized troops—a spectacle devoid

of coherence, clear significance, or climax. At one point he stops on a hillock “to see what was going on, but strain his attention as he would he could not understand or make out anything of what was happening: there in the smoke men of some sort were moving about, and in front and behind moved lines of troops; but why, whither, and who they were, it was impossible to make out” (book 2, chap. 17).

Under the perceptual problem is the quantitative problem, the problem of number, and it is here that the paradoxical duality of Tolstoy’s argument makes itself felt. If the irremediable chaos of the battle experience corresponds to the multitudinousness of causes and their imperviousness to hierarchizing, nevertheless Tolstoy allows for collective phenomena, such as the difference in resolve that wins battles in spite of the terrain, equipment, and relative numbers. Further, if causation, that is, determinism, rules and no particle can be discounted, as Tolstoy asserts, then deriving “the direction of motion” as the sum of “a countless number of free forces (for nowhere is man freer than during a battle...)” (book 13, chap. 6) would seem to admit of agency, though the calculation remains hopeless. Consequently Tolstoy passes from mechanics to mathematics, though the framework of mechanics remains powerful in the narrative. It operates, for example, in his overview of a great movement from west to east, starting in Paris in 1789. The movement reaches its limit—having expended its latent energy—at Moscow in 1812 and then reverses direction, pendulum fashion, in a drive from east to west, ending in Paris, where it began (epilogue 2, chap. 1). But such description is no explanation; for that there must be found a way of reconciling “the unconscious, general swarm-life” (book 9, chap. 1), which is the life of peoples, with the myriad individual lives and the “innumerable conflicts of individual wills” from which everything results (book 10, chap. 7). Tolstoy’s proposal draws on the model of the calculus: “Only by taking an infinitesimally small unit for observation (the differential of history, that is, the individual tendencies of men) and attaining to the art of integrating them (that is, finding the sum of these infinitesimals) can we hope to arrive at the laws of history” (book 11, chap. 1).

The gap between concrete experience and faith in a universe of laws is not new in the history of thought or, for that matter, in the history of representation. Despite its scientific trappings, Tolstoy’s recourse for bridging the gap is a flight of metaphor offering a rationale for the great work of historical representation on which he was then engaged. He there offers a history of individuals, integrated imaginatively into the vast, inclusive movements and events of their turbulent times. At no point is he prepared to discount the experience of individuals, which, in all its particularity, immediacy, purblind selectivity, willfulness, cross purposes, self-delusion, and cognitive failure, constitutes the historical reality. Tolstoy in *War and Peace* does not erase the gap by rejecting the realm of experience as delusive, like so many of his idealist predecessors, nor by denying in his art or thought its chaotic complexity, concentrated and exemplified on the field of battle. Nor does he separate the experiencing subject from the externalities that affect it. Tolstoy’s reality is as much an interaction as William James’s, and egotistical self-delusion aside, there is no satisfactory alternative to what the experiencing consciousness is able to make of the battle, except that adumbrated in Andrey’s two deaths: at Austerlitz, the infinite sky and the nothingness behind it; and after Borodino, love, acceptance, and finally their absorption in an

inexpressible otherness called “the awakening from life.”

But that is what Tolstoy at this stage in his thinking was wont to call “metaphysics.” Though he could not deny experience its authority, neither could he forego the passion to understand this world as a world of laws. So, in his second epilogue (chap. 10), he observes that just as in the science of his century what is still unknown, and thus falls outside “the laws of inevitability,” is called “vital force,” so in history “what is known to us we call the laws of inevitability, and what is unknown we call free will. Free will is for history only an expression for the unknown remainder of what we know about the laws of human life.” In the science of the twentieth century, “chaos” was the expression applied to “the unknown remainder” of what was known about the laws of the physical world, all that which, on the Newtonian scale, long eluded predictive description in mathematical language and once seemed anomic in principle. In point of fact, Tolstoy’s characterization is apt for whatever it is that mankind in various times and conditions has sought to represent as “chaos.” For Tolstoy, free will, the unknown remainder that seems anomic in principle, is chaos, and in a real sense so is freedom itself. But while free will—were we to know all—may be illusory, it is rooted in the immediacy of experience. The remoter the event, Tolstoy points out, the less need there is for free will in historical explanation. But it is its experiential immediacy, not to be gainsaid, which constitutes the human reality and therefore the true if chaotic nature of human history.

## ARMAGEDDON AND APOCALYPSE

Thanks to the power of journalism, “Armageddon” became a synonym for the First World War. The name appears in the Bible only in Revelation, as the site of muster for the great last battle before the earth, its inhabitants, and indeed the whole creation come to judgment and pass away. Armageddon takes its name from its putative locale (perhaps the Mount of Megiddo), like “Waterloo” or “Gettysburg,” but then, as the battle to end all battles, it lent that name to “The War to End All Wars.” Before World War I, a secular-minded writer might label any great impending conflict “an Armageddon.”<sup>77</sup> And with the advent of what also became known as the Great War, the term found favor for its suggestion of a showdown between the powers of light and the powers of darkness, our side and theirs. But before it was over, the war became not an Armageddon but plain Armageddon, the battle that signifies apocalypse.

War as an apocalyptic transformation, wherein the familiar world—a society, a nation, a cosmic order—is turned or returned to chaos is implicit in the representations of war in Grimmelshausen’s novel no less than in Goya’s and Dix’s print series. The imagery of the book of Revelation affects how one reads Goya’s anomalous beasts and Dix’s wastelands, and it affects the symbolic figuration of war and its consequences in Rubens, Picasso, and popular cartoon imagery. Goya’s *Desastres*, however anchored in the actualities of occupation and resistance, incorporates in its design War, Pestilence, Famine, and Death: the Four Horsemen of the Apocalypse, as commonly understood (Rev. 6:1–8). Rubens’s *Horrors of War*, however rooted in classical mythography, also represents Famine and



Pestilence in monstrous personifications, along with War as Mars and Death in the slaughter that has begun. Most comprehensively, Bruegel, in an amalgam of sacred and secular, traditional and topical-allegorical, paints a *Triumph of Death* (1562) as an Armageddon wherein skeleton armies, with half the sky ablaze and scenes of death and destruction everywhere, surprise and overwhelm all the living, while in the center of the composition a skeleton wielding a scythe sits on a galloping bony red horse, a conflation of the traditional Grim Reaper and the apocalyptic image of War with his red mount and great sword (Rev. 6:4). Earth, sea, air, and fire are comprehended in this crowded Doomsday landscape, consumed in the final battle.

The battle at the end of the world has haunted the imaginations of many peoples, with a particularly vigorous strain descending from the eschatological narratives of the ancient Near East. It would appear that even the Ragnarök of the Norsemen, the final anarchy that brings about the return to chaos, was affected by the Christian version of the last battle. In this form, there is a disposition to envisage Armageddon as a preliminary, and the chaotic end of the world a prologue, to the postsecular order of eternity. Nevertheless, the apocalyptic imagination in turbulent Europe well understood catastrophe, and fed on those projections of universal flood and obliterating fire that, along with the destruction of cities and empires, punctuate the biblical narrative. Whatever the stimulus to apocalyptic vision, whether it lies in the dread of personal or communal extinction, a yearning for consummation, or simply responds to historical experience enlarged and extrapolated, the poetic and pictorial visions of a chaotic end to things have regularly enlisted the imagery of war. But in the twentieth century, the metaphoric current can be said to have run the other way. Faced with the scale and destructiveness of twentieth-century war, the imagination sought an adequate correlative in the language and imagery of apocalypse.

Universal ruin comes in two forms: as violent catastrophe and as its aftermath. Though nineteenth-century artists like John Martin and J. M. W. Turner had available a tradition for representing the spectacle of ruin as a melancholy landscape, a retrospect, they were drawn to the challenge of representing the vast energies of the moment of catastrophe itself. In the First World War, a number of artists of the avant-garde took such a stance at the outset, Dix as we have seen among them. Marinetti, in his futurist manifestos, famously embraced the violent energies of Armageddon as positively hygienic. The only beauty, he declared, was in the destructive products of chaos. "The red holidays of genius have begun! There is nothing for us to admire today but the dreadful symphonies of the shrapnels and the mad sculptures that our inspired artillery moulds among the masses of the enemy."<sup>78</sup> The image of violent explosion lent itself to both abstraction and symbolic suggestion, as in C. R. W. Nevinson's *Bursting Shell* (1915), with its ambiguously expansive and centripetal rays, spiraling incandescence, dissolving hexagonal container, and spatial distortion.

Nevertheless, the Great War ultimately found its characteristic imagery in the wasteland, Armageddon seen not as heroic storm but in its ruinous result. This was not a reversion to the scene of ruin as the occasion for melancholy reflection, softened by time. In such elegiac romantic practice, the spectacle of ruin was something filtered through a subjective presence that gave it moral and metaphysical meaning (as in the recurrent motif of the Last Man). In the twentieth century's apocalyptic wasteland, the presence or absence of

survivors in the scene makes less of a difference. The shattered wreckage marking the vacancies of the desolate field is the comprehensive reality; the survivors, like the corpses, are part of the debris. So, among the deeply felt but dryly rendered paintings of Paul Nash, *We Are Making a New World* (1918) shows a frozen and depopulated scene, the churned earth in grotesque icy hummocks and holes hinting at trenches and their erstwhile occupants, the blasted tree trunks dark against the wall of red cloud and quadrant of pale sky where the rising sun complements the irony of the title. There are no witnesses, no makers. On the other hand, Nash's visionary *Menin Road* (1919) shows scattered groups of small figures in the midst of a no less devastated landscape, pitted ochre earth mingling with water in pools and streaks and littered with corrugated metal and other debris (fig. 5.46). The water and a few formidable building blocks in the foreground cut off the spectator. Once more blasted tree trunks, a series of vertical accents, straggle across the center along what was once the road, and plumes and clouds of smoke close in the sky and the distance. The scene is oddly beautiful, the light striking in between cloud and smoke washing over the pale, drab colors and reflecting from the flooded trenches and still waters. But the pair of soldiers between crater and tree trunk, echoed in the distance and dwarfed by the scene, are almost beside the point, a spot of residual movement on the wrecked earth, less of a moral and intellectual filter or an ordering presence than the upright stripped and blasted trees.<sup>79</sup>



FIGURE 5.46. Paul Nash, *The Menin Road* (1919). Oil paint on canvas.

Source: Imperial War Museum, London. © Imperial War Museums (Art IWM ART 2242).

Like the pair in the Nash painting, the poet and playwright John Masefield and a companion traversed such a visionary scene in the fourth year of the war, after the battle of the Ancre, and Masefield's powerful evocation of the ruined land in a letter to his wife conveys the scale of its vast monotony and elemental confusion, along with its heterogeneous obscenity:

It is no good trying to describe the land...mile after mile of it, wherever you look, is blown into holes, mostly very big deep holes, half full of water, & running into each other, & without any grass, but all raw & filthy, & littered with bits of man & bits of wagons, & old ragged sandbags, helmets, skulls, barbed wire, boots with feet in them, bombs, shells eclats [sic],

till it looked like an ash heap put as a dressing on a kind of putrid pox that was cankering the whole earth. You can perhaps imagine what walking on such mud means. There is no skin nor grass nor twig nor shrub nor building nor anything left alive upon it. It is bedevilled mud, with a few broken bricks where the village stood, & a swill of mud where the road was, and we wandered in that kind of land for hours & hours.<sup>80</sup>

For Otto Dix and for many other artists, it was only after the war that an entropic wasteland, No Man's Land writ large, became the master image for the Armageddon that had exploded so much cordite and had concentrated, organized, and released such vast and violent energies. While at the front and in the war zone, Dix had made hundreds of drawings, including a number of brilliant gouaches, that reflected his changing vision. Among them was a drawing titled *The Trench* (1918), a violent, vortical chaos of color and energy, spotted with apocalyptic heads and pierced human figures spurting blood.<sup>81</sup> Dix's first major painting after the war (probably destroyed in the Nazi purge of "Degenerate Art" but recorded in photographs) was also titled *The Trench* (*Der Schützengraben*). An attempt to condense the war into a single visual statement, it was a nightmare in grisly detail, a shambles of rotting corpses half buried within the catastrophic ruin of the trench, whose original character is scarcely discernible. Far from the chaotic fire and energy of the drawing, it was instead a crowded representation of dissolution and paralysis, of frozen gesture and decaying flesh, of rags and shattered weapons, the ruin and debris of war around a center of darkness. One of the blasted, rigid corpses, arm half raised, looking skyward, and freakishly held aloft on something like a platform supported by bent metal struts, would recur in later work with even more blatant indexical symbolism.

Such symbolic suggestion, overtly eschatological, is muted in the suite of etchings Dix began in 1923 on completion of *The Trench*, in many respects the analytical unpacking of that painting.<sup>82</sup> But it is developed in Dix's ambitious triptych in the form of an altarpiece, painted in the next decade ([fig. 5.47](#)), also titled *Der Krieg* (1929–1932), where, in the earth-toned center panel, the elevated and desiccated corpse suspended on bent steel struts now hangs face down over the devastation and points across the carnage and ruin beneath to the naked, riddled legs in the air of an upside-down corpse. The triptych with its predella is redolent of a crucifixion but also carries suggestions of an apocalyptic Last Judgment scene, with, on the viewer's left, in place of the anonymous ranks of the saved, an endless column of soldiers moving up through the dawn mist—their road to Calvary—and, on the right, in place of the torments of the damned, a grim, straining figure, looking like Dix, hauling an atrociously wounded man out of the blazing inferno behind him. The central panel of *Der Krieg* recalls *The Trench* but raises the viewpoint to include a bleached desolation reaching to the horizon, with the remains of houses, a line of dead tree trunks like that along the Menin Road, and a bare, cratered elevation.<sup>83</sup> Finally, in *Flanders* (after Henri Barbusse's "*Le Feu*") (1934–1936), painted in the teeth of the Nazi regime's displeasure and harassment, Dix offered his own version of the morning after the Day of Destruction ([fig. 5.48](#)). Barbusse would have been particularly repugnant to the Nazis, as a socialist, journalist, and Frenchman who had written from the midst of the late conflict a famous novel that oburgates war.

Dated December 1915, that novel, first known in English as *Under Fire: The Story of a Squad*, sought to convey to the home front an unsanitized account of the war in the

trenches as endured by those in the ranks, attaching familiarity to something that remained unspeakably alien.<sup>84</sup> As one of its soldiers comments while briefly reentering life in a town behind the lines, “There’s not just one country.... There’s two. I’m telling you we’re divided into two foreign countries: the front over there...and the rear, here” (277). But in bringing home the war as experienced, with its aimless flux and fixity and its deepening nightmare quality, Barbusse was remarkably successful. His novel was widely known and translated, and it influenced much subsequent literature, and many of its passages could be matched with Dix’s etchings for subject and attitude. When reproductions of twenty-four of these etchings were published in booklet form in 1924, Barbusse wrote an introduction. When Dix acknowledged Barbusse and *Le Feu* in dedicating *Flanders*, he did so in a painting that sought to match the novel’s nearest approach to the representation of a consummated chaos, an account of a work party’s dawn awakening to dissolution, utter exhaustion, ultimate loss of distinguishing identity, succeeding the narrative’s crescendo of fire.



FIGURE 5.47. Otto Dix, *Der Krieg* (The war), triptych (1929–1932). Tempera on wood.

Source: Galerie Neue Meister, Staatliche Kustsammlungen Dresden. © 2014 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn.

Among Barbusse’s innovations was to create a collective protagonist, not one or even several individuals, as in the classic nineteenth-century novels of war, but “a squad,” a group representative in its variety as in its typicality, wherein he, the observing and recording member, is often submerged in the “we.” Though in retrospect a journalist’s and a socialist’s practical approach to evoking the experience of war in the ranks, the device is also the precursor of many subsequent films and stories that take a group of soldiers, ethnically, regionally, and vocationally diverse, through a battle or a war. Needless to say, the squad is nearly wiped out in the course of the narrative, with its heaviest losses in the later episodes.

Claiming the privileges of a journal, the narrative appears disjointed, without transitions or linear progression, like the experience of the squad in its tasks and movements in and out of the line. The war is a flux in the present, with its edges not visible beyond each day.



There is no seeing around it, even in the visionary prologue from a mountain sanatorium or in the final tendentious conversation about the need to kill war: “Faut tuer la guerre.” Nevertheless, the novel builds in intensity, through movement up to the front-line trench under a great artillery barrage, a disastrous patrol in No Man’s Land, and (in the chapter titled “Le feu”) the attack over the ground into the enemy’s trenches and its aftermath. After that dreadful and sustained convulsion, something else is required to achieve a cadence that is not anticlimactic, something opposite to the moment of action. What follows is the journey to a Dantean underground field hospital through the carnage of the battle, a terrain layered with rotting bones and bodies from previous assaults. And then, after a brief interlude in the rear like the glimpse of another world, a final movement that peaks in a visionary scene, absorbing a nightmare fatigue party that had been sent to open a new trench in the dark and rain. After wandering the vast labyrinth of the existing trenches, known and unknown, in use and abandoned, ours and theirs, and driven from their exposed task by water in the trench and ferocious fire, the soldiers collapse, lost and exhausted, to awaken in a great sea of mud and milky, stagnant water. “There are no trenches—the trenches are under those canals. The world is flooded. The battlefield is not asleep, it is dead” (296). There is a prodigious silence among the shapeless, earthen lumps, which might be either French or German soldiers—they are indistinguishable from one another and from the dead, except for the drowned men in the pools. As the scene emerges, it enlarges:

All these men with their corpse-like faces, in front of us and behind, driven to exhaustion, emptied of words and will.... All these men laden with earth, who, you could say, are carrying their own graves, are as alike as if they were naked. On either side a few ghosts are emerging from the ghastly night, dressed in precisely the same uniform of filth and misery.

It is the end of everything. For a moment it is the great stoppage, the epic cessation of war.

At one time I thought that the worst hell of war was the flaming of shells; then, for a long time, I thought it was the suffocation of underground passages that constantly close in on you. But no. Hell is water.

The wind is rising. It is icy cold and its iced breath passes through our flesh. On the drowned and dissolving plain, dotted with corpses between its twisting watercourses and the islands of motionless men sticking together like reptiles, across this levelling and sinking chaos, slight hints of movement appear. You can see bands of men slowly advancing, sections of caravans made up of beings bent beneath the weight of their greatcoats and aprons of mud, dragging themselves along, separating and creeping along beneath the darkened light of the sky. The dawn is so foul that you would think day was already over.

(299)



FIGURE 5.48. Otto Dix, Flandern (zu Henri Barbusse, “Le Feu”) (Flanders [after Henri Barbusse, “Le Feu”]) (1934–1936). Oil and tempera on canvas.

Source: Nationalgalerie, Staatliche Museen, Stiftung Preußischer Kulturbesitz, Berlin. Photo: bpk, Berlin, Jorg P. Anders / Art Resource, NY.

This scene with its primal and postdeluge resonances is, to all intents, the end-of-the-world vision of Dix’s Flandern, his painting “zu Henri Barbusse ‘Le Feu’.” Dix’s brown foreground figures, huddled in their coverings on a ridge between pools, seem rooted in the mud amid the elemental confusion. Three in number, with the soldier at center slumped against a stump crowned with barbed wire, the group suggests yet another crucifixion. Behind, one can make out a number of other soldiers the color of their surroundings, and a bloated corpse floats in the milky green waters. Beyond the foreground elevation is a ravaged plain, water-soaked and denuded, with silhouetted ruins and dead trees. From behind a skeletal town in the distance smoke rises diagonally into the sky. The dawn sky is violent with a blood-red streak, and on the nightward side, striated clouds and the sphere of the sinking moon, reminiscent of the cosmic phenomena that signal the end of things in Revelation. To the left, the streak of red sky turns the waters to blood. It is the wreck of Flanders, the wreck of the battlefield, and the wreck of the world.

The chaos that is the ultimate condition in the visions and experience of war in Dix and Barbusse is one of exhaustion and universal leveling, loss of purposive movement, loss of all distinction and difference, that which gives structure and order to experience not only between French and German, friend and foe, but between life and death, flesh and clay, land and water, light and dark. It is postapocalyptic: a world sunk in terminal entropy, an intensely felt rendering of the conception of chaos that had emerged in the shadow of nineteenth-century thermodynamics (see [chapter 7](#)). But World War II revived the imagery of apocalypse and also restored its energies. The prologue to the war condensed in Picasso’s *Guernica* accrued further meaning, and the painting found its vaster audience. Two events especially caught the apocalyptic imagination, however, and required its rhetoric: the Final Solution in its various manifestations and, hard on the heels of the

firestorm bombings, the first weapons perceived as capable of destroying a city at a stroke, the world in a volley. The moral monstrosity, not to mention the scale of the Holocaust, would in itself invite representation as chaos, but what equally challenged the imagination was the stupendous enlistment of order in its implementation. Organized chaos, a perverse and inimical system masking true chaos, is a paradox that came readily to Milton, Shelley, Blake, and Proudhon. But few representations manage to condense the order and the chaos with the resonant visual concreteness achieved in the sculpture that stands at the Dachau memorial site, where Nandor Glid's agonized, skeletal bodies form the structured tangle of a barbed-wire fence (fig. 5.49).<sup>85</sup> The sculpture, in three dimensions but giving the effect of a frieze, draws on a legacy of bodies and wire from the imagery of that earlier European holocaust, the Great War, as realized memorably in Otto Dix's *Der Krieg*. In Dix's "Dance of Death year 17 (Dead Man's Hill)" (2, no. 9), bodies and wire in grotesque conjunction anticipate Glid's structured array with unexpected cogency (fig. 5.50). A grid of horizontal wavy lines, the wire, marked by vertical posts and dangling scraps of wood, is hung with mostly anonymous (one, German-helmeted) corpses in various states of decay. These are caught in attitudes grotesque and graceful, radiating outward from a center like an explosion or, alternatively, a centrifugally frozen ring dance. Nandor Glid's sculpture incorporates the grid but exists in horizontal extension without closure, its skeletal bodies at one with the mostly implied wire, the barb clusters rendered as hands reaching (vainly) skyward and outward. In the one, the appearance of pattern and order in the chaos is bitter irony. In the other, it is tragedy.



FIGURE 5.49. Nandor Glid, sculpture, Dachau Memorial site (1959–1968).

Source: Photo © Martin Gemell Photography.



FIGURE 5.50. Otto Dix, Totentanz anno 17 (Höhe Toter Mann) (Dance of Death year 17 [Dead Man's Hill]). Etching, aquatint, and drypoint, from *Der Krieg*, folio 2.9 (1924).

Source: Gift of Abby Aldrich Rockefeller, Museum of Modern Art. Digital image © Museum of Modern Art / Licensed by SCALA / Art Resource, NY. © 2014 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn.

The advent of the atomic age, on the other hand, gave a simpler challenge to the imagination of chaos. Here sheer destructive force (albeit the product of scientific rationality and the instrument of a pragmatic calculus) evoked the definitive apocalypse: uncreation not as metaphor but as a new immanent probability. The uncreating energy of the moment of explosion and its immediate effects found vivid clinical exposition in John Hersey's memoir on Hiroshima, but the specter, and so the characteristic representation, of nuclear apocalypse was above all anticipatory. And in anticipation, war as an apocalyptic event, sudden and complete, could also be imagined as inaugurating a return to war as the permanent condition, a second stage of chaos, a Hobbesian aftermath for the survivors. So, the scenarios that culminated in Doomsday—like Stanley Kubrick's *Doctor Strangelove* (1964), brilliantly mocking the agents of our fears—and the conclusive symbolism of the mushroom cloud, where chaos and uncreation happen in the moment of nuclear exchange, could share the field with representations of the anarchy and the entropy of a postnuclear world. On the one hand, there is the violently anarchic film world of *The Road Warrior* (or *Mad Max 2*, 1981) and its progeny and Cormac McCarthy's novel (2007) and its translation to film, *The Road* (2009); on the other hand, there is the elegiac quenching of humanity in Nevil Shute's novel and Stanley Kramer's film *On the Beach* (1957/1959) and its final stage, approaching flatline, in the dying spark of Beckett's *Endgame* (1957).

*Endgame*, whose governing trope is the comedic rendering of an advanced entropic chaos, resists a limiting historical specificity, as of a postnuclear apocalypse or a World War I wasteland, though it draws suggestion from both and even invites such associations. The setting and situation clearly belong to the lingering and dying aftermath of some apocalyptic event. But the emptiness visible from the bunker windows as reported by Clov



—zero in all directions—echoes the wasteland emptiness that was the Great War’s contribution to the imagination of battle and consequently to the representation of the chaos that found its concrete analogue in war. The war on the Western Front was in effect one long battle, a chronic fever marked by paroxysms of attack and barrage. Yet the startling quality of the battlefield, apart from its scale and dimensions, was the emptiness of what heretofore would have appeared as a site of fierce and crowded activity. Jünger speaks of “the chaotic vacancy of the battlefield,” with its murderous interludes when the infantryman comes into the open.<sup>86</sup> The most strenuously contested ground, the very front of battle, had now become No Man’s Land. The depopulated, wire-bound, pocked and suppurating landscape of No Man’s Land at its worst, the disappearance of the engaged armies into the trench system and of the deadly and dominant artillery to concealed positions in the rear, offered the anomaly Reginald Farrer could describe as a “crowded emptiness,” a landscape “full of emptiness,” in his 1918 account, *The Void of War*.<sup>87</sup> As the trench system enlarged and shifted, as the devastation spilled over to the villages and approaches and the fought-over ground, such comprehensive wasteland images as *The Menin Road* could come to stand for the war as chaos and chaos as war. The war that was actually a prodigious, unprecedented expenditure of energy, chaos in the active mode, found a lasting expression in postwar art and literature as a plenary vacancy, a version of the chaos that realizes itself in negation, that gives presence to absence, that (with St. Augustine) struggles to embody the unimaginable in nothing.

Zero in all directions is also a kind of found order. The ordering imperative with respect to war finds its public expression in the plethora of national museums that collect and preserve the records, artifacts, and representations of war, most of them taking their impetus from the catastrophic conflicts of the twentieth century. But a shift in the balance between the need for containment in an ordered perspective and the recognition, laced with dread, of the uncontainable in recent experience and prospective threat appears emblematically in the contrast between the first form of Britain’s Imperial War Museum compared to that of its most recent offshoot. The original Imperial War Museum, launched in 1917, found its permanent London home in what had been the Bethlehem Royal Hospital (or “Bedlam”), a building finished in 1814 with later additions and subtractions. The museum presents an effect of monumental neoclassical symmetry, of civilized, rational containment, eloquent in its massive Doric portico, central axis, lateral extensions, crowning dome (replacing an original cupola), its balance, solidity, and authority reinforced by an approach between two massive, symmetrically placed fifteen-inch guns ([fig. 5.51](#)). In the aftermath of World War II, the museum developed a number of offshoots at other locations (e.g., the former fighter base at Duxford), the most recent being the Imperial War Museum North in a section of greater Manchester. The architect was Daniel Libeskind, the designer of the new portion of Berlin’s resurrected Jewish Museum. His studio website declares that the Manchester museum “deals with the conflicts that have shaped the 20th century” and that “the concept for the project is that of a globe shattered into fragments and then reassembled as an iconic emblem of conflict.”<sup>88</sup> The shards, connecting and abruptly interpenetrating, are intended to represent earth, air, and water, serendipitously invoking both the three main branches of the military and three of the traditional four elements that—

with fire, here implicit—constitute our world (fig. 5.52). Coming to the opening, the art critic Richard Cork registers “an image of disintegration”:

Gleaming in the northern light, the lower shards swerve, buckle and swoop like segments of an aluminium-clad fortress riven by a seismic tremor. The Air Shard surges above them, but its jagged profile appears to have suffered a savage truncation, and tilts at an unsteady angle to the nearby waterfront.

From the outset Libeskind confronts us with the central idea of damage. Rather than exulting in the power of doughty, machine-age armaments like its parent museum down south, his lean building insists on the outcome of devastation.<sup>89</sup>



FIGURE 5.51. Imperial War Museum (London). Architect: James Lewis (1812–1814).

Source: Collection of the author.



FIGURE 5.52. Imperial War Museum North (2001). Architect: Daniel Libeskind.

Source: Photo: Ian Britton, FreeFoto.com.

Inside, Cork reports, the idea of a disorienting “world in extremis” is carried through:

from the bunker-like entrance; to the interrupting, vertiginous Air Shard with its 4.5 degree tilt, its mesh floor, and wind through the cladding; to the curved floor and ceiling of the Earth Shard, and the Harrier jet hanging at a perilous tilt; to the views over the ship canal and the once great inland port, trashed in the bombing of World War II. “Everything—walls, ceilings, staircases, corridors—assaults the visitor at acute, jutting angles” with “intimations of instability.” Cork calls it an “apocalyptic museum” designed to promote engagement and unease. It seeks, paradoxically, to give permanent presence and agency to the chaos unleashed in war’s turmoil and insecurity, the human experiences that have made war from earliest times so apt a vehicle, so prevalent a metaphor, so regular a conscript for the representation of unmitigated chaos.

# ENERGY

## MATTER IN MOTION (INERTIA, FRICTION, NOISE)

“Then idiots talk,” said Eugene, leaning back, folding his arms, smoking with his eyes shut, and speaking slightly through his nose, “of Energy. If there is a word in the dictionary under any letter from A to Z that I abominate, it is Energy. It is such a conventional superstition, such parrot gabble.”

—Charles Dickens, *Our Mutual Friend* (1863)

Energy, as motion, turmoil, conflict and collision, was implicit in most of the imaginings of chaos that saw it as a state of something rather than as a profound nothing. From the turbulence and unpredictability of an inchoate oceanic all, to the metaphoric wars of the primal elements, to the carnival ferment and release when normal structures of constraint were reversed or abolished, to the final Armageddon, an uncontrollable energy was inextricably associated with chaos, chaos conceived as the absolute of disorder. In that character, chaotic energy, unconditioned and unconstrained, carried a drastically negative report. Antithetical to cosmos, chaos in whatever medium and setting was energetic turmoil and as such was to be shunned as inimical to life, security, social order, rational expectation, peace, predictability, beauty, and justice. Perhaps only among the early physical philosophers did such disruptive force have something to be said for it: as Strife in Empedocles’ account of its dialogue with Love, both principles necessary for a world vibrating between cohesion and differentiation, and as the energetic ground state of universal becoming in Heraclitus, expressed as elemental fire.<sup>1</sup>

In a world full of threats to life, limb, and property, it takes an effort to go beyond the thought that order is good and chaos is bad, and so doubtless they continue in the value systems of the vast majority of mankind. Yet at some point during the traverse between the eighteenth and nineteenth centuries, a radical transvaluation announced itself in European thought and sensibility, one that gave a new face to chaos. A transvaluation with respect to disruptive turmoil and in the relations between energy and form marked the first of the great modern shifts in the imagination of chaos. It arose in the lee of two centuries of scientific achievement that had wrought the binaries of stability and change, stasis and motion, into a triumphantly unified and intellectually dominant conceptual model for the organization of order in the physical world. But in a climate—social, political, and industrial—rife with the forces of change, agents often at odds with established institutional and cultural arrangements, energy as the lever of transformation, as disruptive of stasis, containment, and confinement, as destructive of order, found an advocacy. Energetic chaos could be felt as valuable and liberating, could be embraced as potentiality, as freedom, as the condition of progress, as life, while order could be resented as oppressive and inhibiting, as confinement, deprivation, a reduced semblance of life. The difference lay between life as a



protean energy transcending the many forms into which it might flow and—perhaps paradoxically—the pseudolife of the perfect machine.

The object of this chapter is to plot the emergence of this new face of chaos in the age of revolutions, in tandem with a new presence and function in the scientific imagination for unconditioned—or abstract—energy. The history of the generalization and elaboration of the concept of energy, a story of immense scientific and historical interest, extends far beyond its involvement in the changing imagination of chaos.<sup>2</sup> But involved it was, from the start, and, as sometimes happens, the poets here anticipated the philosophers, natural and other. From the perspective of that involvement, four overlapping and weakly dialectical phases can be discerned. In the first, energy appears in the character of a liberating and destabilizing force, a living force or *vis viva* inimical to system, or whatever is closed and mechanical. In the second, energy is made the currency of a new comprehensive system, universal in its reach and quantitatively stable, obedient to the laws of its conservation. In the third phase, it engenders a dark doppelgänger, a Mr. Hyde to its Doctor Jekyll. In contrast to the quantitative stability and closed circulation of energy, this implacable companion appears as ever-enlarging and irreversibly undoing, a qualitative abyss of boundless appetite. Here, with the physicist's invention of energy's shadow, entropy, came the second great revolution in the modern imagination of chaos. A cuckoo's egg initially designed to keep the premise of energy's conservation in countenance, entropy so effectively siphoned off systematic disorder that it transformed the notion of chaos, and a discussion of it requires a chapter to itself. In a fourth phase, however, energy took a step beyond the uneasy complementarity of conservation and dissipation, in the radical abrogation of its antinomy with matter and structure. No longer other, the enemy or alternative to form, energy becomes once more the foundation of material being, reliably unstable and predictably unpredictable. In the arts, meanwhile, the recrudescence of the Romantic rebellion that once pitted unconditioned energy against the logic of the machine finds expression in an aggressive synthesis, an apotheosis of mechanical energy celebrating—in the spirit of Marinetti—the dynamic chaos of the twentieth century.

In the next section, "Energy Unbound," I shall largely attend to the earlier two of these four phases in a range of representations. But in the current section, "Matter in Motion," I shall attempt to set the stage for the revolution in thought and sensibility that demanded a wholesale reversal of signs, challenging everything that was taken for granted about the relative merits of chaos and order. Its revolutionary extremity gives the measure of the immense power and authority of the then dominant paradigm, whose monument was no less than the universe according to Newton.

## STATICS AND DYNAMICS

Before energy, there was inertia. That is to say, before the nineteenth century found a grand unifying term for the forces at work in the physical world, astronomical and molecular, electromagnetic and mechanical, Newton had brought together motion and rest in an overarching kinetic stability. "Energy" would later assert its dominion in a deceptively

parsimonious formulation, as “the capacity to do work”<sup>3</sup> and so to effect change, including change in the rate and direction of change. “Inertia” was all about the resistance to change. Though Newton himself found reason to question the likelihood of a perfect and perpetual stability and firmly rejected mere mechanism in the cosmic order, the vision derived from his *Principia* (1687), or *Mathematical Principles of Natural Philosophy*, was that of a perfect dynamic equilibrium, architecture in motion sustained by unifying laws, tendencies, definitions, where the disposition to effortless persistence is fundamental.

Near the head of the *Principia*, in the first of Newton’s “Axioms; or Laws of Motion,” the state of motion and the state of rest are united in the universal tendency to persist, linked by the seemingly modest conjunction “or”: “Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon.”<sup>4</sup> The embracing term for this disposition to go on in the same way and to resist change first appears among the prior “Definitions.” The “power of resisting, by which every body, as much as in it lies, endeavours to preserve its present state,” Newton there explains with emphasis, “may, by a most significant name, be called *vis inertiae*, or force of inactivity.”<sup>5</sup> Newton here further attenuates by relational ambiguity the differences between motion and rest, for he notes that this innate “force of inactivity” can be thought of not only as resistance but as impulse. It is impulse in so far as a body withstanding another’s “impressed force” simultaneously affects the state of that other body. In effect, “motion and rest, as commonly conceived, are only relatively distinguished; nor are those bodies truly at rest which commonly are taken to be so.” This assimilation of impulse and resistance one to the other will find another form of expression in Newton’s third law of motion. Meanwhile, relativizing motion and rest befits a system in which motion actually constitutes a kind of rest, like the spinning of a frictionless gyroscope in the vacuum of space.

The third law of motion brought a further stabilization to the scene by formulating a compensatory mechanism, one able to digest all impulse and absorb all change. The third law asserts that “To every action there is always opposed an equal reaction; or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts.” Reciprocity of action imports reciprocity of change, change whose “equality” depends on taking precise account of the mass and motion of the bodies in question. But as formulated, the third law in its very language and syntax cannot help but suggest, beyond equivalence, a neutralization of action, either through outright cancellation or automatic compensation in the system, a local homeostasis that preserves the moving whole from disruption.

The power that keeps Newton’s moving cosmos from flying apart along right lines is of course the “centripetal force” (Newton’s coinage) called gravitation, that universal attraction between bodies and parts of bodies whose action Newton was able to describe with such mathematical elegance and transparency. But—reversing perspective—since the orbiting planets only manage to resist gravitation and keep their distance by virtue of their inertial motion, other resistances—as by a retarding medium in the interplanetary spaces—could bring the whole moving system down. In explaining his first law, Newton illustrates inertial persistence with a spinning top, which “does not cease its rotation, otherwise than it is retarded by the air. The greater bodies of the planets and comets, meeting with less

resistance in more free spaces, preserve their motions both progressive and circular for a much longer time" (14). Later, in the *Opticks*, speculating on the role of an insensible ether, Newton is quick to discount its possible effect on planetary motion, in contrast to the hypothetical "Fluid" that fills the voidless plenum in Cartesian models of the cosmos. Ethereal resistance Newton supposes "as so small as to be inconsiderable, as above 6000000000 times less than that of Water. And so small a resistance would scarce make any sensible alteration in the Motions of the Planets in ten thousand Years."<sup>6</sup> As for the Cartesian continuum, he argues (a little circularly) that "a great Objection arises from the regular and lasting Motions of the Planets and Comets.... For thence it is manifest that the Heavens are void of all sensible Resistance, and by consequence of all sensible Matter."<sup>7</sup> That Newton in the upshot required not only a Creator to get things going but "active Principles" for "conserving and recruiting" the sum of motion in the solar system<sup>8</sup> did not prevent his grand unification of terrestrial and celestial mechanics from becoming the blueprint of a steady-state clockwork universe. The system of the world that Newton has imagined yearns toward an unqualified kinetic stability, and therein lay its appeal for his intellectual heirs.

It in no way lessens Newton's impact or achievement to note that his laws of motion and their application to the cosmos crowned a revolution with a number of prior heroes. Galileo, followed by Gassendi and others, had laid the groundwork experimentally and conceptually for the generalization of inertia. Descartes had added the crucial element of the disposition to move in a straight line to the perceived tendency to persist in states of motion or rest absent countervailing forces. With respect to the motion and continuation of the cosmos, Borelli, Huygens, and Newton's contemporary and rival Hooke all understood the inertial problem that Newton solved by quantifying and conceptualizing gravitation. The solution, moreover, rested on Kepler's two laws of planetary motion (1609), which Kepler had coupled with a system impelled by a solar and magnetic motor. After Kepler, as Thomas Kuhn points out, the "conception of the solar system as a self-contained and self-governing machine recurred again and again."<sup>9</sup> Despite Newton's occasional scientific and metaphysical misgivings, such was the conception informing the "Newtonian Universe," the inspired and inspiring system of the world for which he was celebrated in the next century and a half while its perfection was refined and confirmed.

What happens to chaos in a world characterized by the kinetic stability of a perpetual-motion machine? What is its imagined role in the physical realm, past and present? And in the incorporate but far from correlative world of men? What is its future, if any?

Late in 1692, Richard Bentley, chaplain to the bishop of Worcester and in due course the greatest classical scholar of his day, preached a set of sermons enlisting science in the cause of religion. Rather audaciously, he sought arguments for divinity in the system of the world outlined in the *Principia* five years earlier and direct guidance on his reasoning about physical matters from Newton himself. Bentley's sermons fit the intent of the lecture series founded by the great natural scientist, Robert Boyle, for the defense of Christianity against unbelievers, and Newton extended himself to be helpful. Bentley's particular target in his eighth discourse was the cosmogenesis of the atomists, whose physical ideas (with Boyle's help) had undergone a great revival in the seventeenth century and were deeply implicated

in both Newton's and Boyle's contributions to the new sciences of matter. Neither, however, found reason to substitute, for the Mosaic account of the Creation, the Epicurean/Lucretian hypotheses on cosmogenesis through the fortuitous concatenation of atoms in the void against a background of chaotic instability. Newton saw his principles as underlying the architecture of the universe but not as organizing its evolution. Later, he would write that it well became the Creator of the primitive particles that constitute all matter "to set them in order. And if he did so, it's unphilosophical [unscientific] to seek for any other Origin of the World, or to pretend that it might arise out of a Chaos by the mere Laws of Nature; though being once form'd, it may continue by those Laws for many Ages."<sup>10</sup> Furthermore, since gravitation appeared to be action at a distance and was not, as Newton insisted, an inherent property of matter (like mass), it bespoke the continuing agency of "an immaterial and divine Power" (Bentley's phrase) in sustaining the system of the world. Bentley could argue that Newton's discovery of gravitation revealed the fatal flaw in the atheists' arguments, for if gravitation were intrinsic to matter, "the present form of our System must have continued from all eternity"; neither could there have been a succession of systems, "in infinite Vicissitudes from all past eternity," for how could any system "against its inherent principle of mutual Attraction...diffuse it self in a Chaos?" Bentley found the conclusion inescapable: "that upon all accounts the essential power of Gravitation or Attraction is irreconcilable with the Atheist's own Doctrine of a Chaos."<sup>11</sup>

The tendency in the Newtonian system, as it made its way into general acceptance and as scientists resolved remaining anomalies and irregularities in observed orbital motions, was to banish chaos from the existent physical world. Celestial mechanics offered a standard, but one applicable to all phenomena subject to the uniformity of physical law. Chaos was outside the system. However, in the imagination of at least one cosmologist seeking to explain the geophysical evidence and perhaps bridge the gap between sacred and profane in the dynamics of geohistory, chaos was not confined to a discrete cosmic prologue. It also formed part of the historical present and the revealed future. A few years before the appearance of the *Principia*, this other bold venturer on strange seas of thought consulted Newton about a soon-to-be-published work principally concerned with the evolution of the earth, though not without reference to other planets and a vast universe (probably inhabited), where stars were suns with their own planetary systems. In his *Telluris Theoria Sacra*, or *Sacred Theory of the Earth*, Thomas Burnet sought physical explanations for physical phenomena, like a conscientious natural philosopher, but at the same time sought to establish their congruence with biblical history and prophecy. Burnet's macroscopic geology first appeared in 1681 in two books, later amplified to four, and like the work of his spiritual descendant, Emmanuel Velikovsky, it generated considerable enthusiasm among a lay readership including the king and such cultural arbiters as Addison and Steele and went through several editions.<sup>12</sup>

Burnet's theory rested on an intrinsic instability, the legacy of the earth's evolution from chaos. It argued that the world before the flood and the world after differ profoundly, as a pristine work of architecture—say, a temple—differs from a catastrophic ruin. Burnet explains the transition to the present world and projects its future course in terms of mechanical forces whose effects are supported both by observation and by Scripture. The



history of the earth then appears as a progress through seven stages, from primal chaos to final apotheosis, including two terrestrial catastrophic events—chaos redux in historical time—and two ages of comparative earthly perfection. These seven epochs are illustrated in an emblematic frontispiece that summarizes and systematizes the whole history of the world (fig. 6.1). Chaos in its several avatars would seem to occupy half that history, but it is ultimately contained in the circular form of the progression, presided over by the Alpha and Omega, the timeless beginning and end of all. Opposite Him—midway between the first and last stages and placed between the watery chaos of the deluge and the fiery chaos of the wrath to come—is the present-day earth, marked with its irregular continents, its erratic mountains, and uneven seas.

The radical thesis in Burnet's book involves the intrinsic physical mechanism that produced such a result. The process, clockwise, begins with the primal chaos, as much classical as Mosaic, whose dark, textured surface represents a fluid mass of particulates "without distinction of Elements; made up of all variety of parts, but without Order, or any determinate Form; which is the true description of a Chaos."<sup>13</sup> Burnet postulates the sinking of the grosser elements to the center of the mass, where they compress and harden, and the separation of the lighter parts into liquid and volatile zones. But then he departs from the conventional in projecting a separation in the liquid zone "as in Cream and thin Milk, Oil and Water, and such like" (book 1, chap. 5, p. 56), while great quantities of the lighter particulates settled out of the air to form the earth's crust. With the chaos conceived as "a fluid mass, which we know doth necessarily fall into a Spherical surface, whose parts are equi-distant from the Center," the crust would be "smooth, regular and uniform, without Mountains, and without a Sea" (book 1, chap. 5, p. 60), like the shell of an egg. (Burnet notes the frequency of that trope in creation stories.) This, he argues, is the antediluvian world enjoyed by the generations before Noah, and it appears in the illustration in all its smooth perfection.

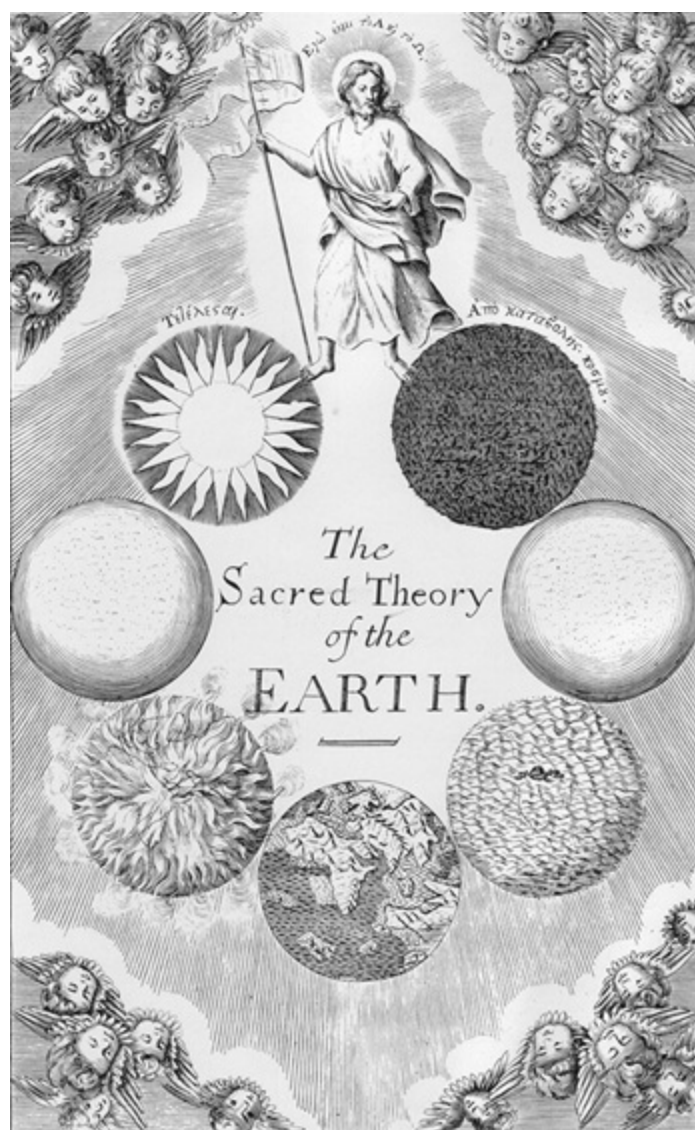


FIGURE 6.1. Thomas Burnet, *The Sacred Theory of the Earth* (1690–1691), frontispiece.

The deluge and the world that succeeds it he makes a direct consequence of the collapse of this shell and the breaking open of “the Fountains of the Abygge, Gen. 7:11 when the waters gusht out, as out of the great womb of Nature” (book 1, chap. 7, p. 77). Burnet gives tentative naturalistic explanations for the collapse of the shell—through its natural drying and cracking, through the softening effect of the rains—while calling attention to the providential alignment between natural and moral processes.<sup>14</sup> He writes of the difficulty of representing to ourselves “this strange Scene of things, when the Deluge was in its fury and extremity; when the Earth was broken and swallow’d up in the Abygge, whose raging waters rise higher than the Mountains, and fill’d the Air with broken waves, with an universal mist, and with thick darkness, so as Nature seem’d to be in a second Chaos” (book 1, chap. 8, p. 84). Nevertheless, his developed account of the global catastrophe—the convulsion in the atmosphere, the concussion of the crustal collapse, the scale of the forces unleashed—is vivid and concrete in the best style of the seventeenth century. Unlike the primal soup of the first phase, it is a chaos of forces in action. The third circle in Burnet’s frontispiece illustration attempts to represent the result, with the outlines of the world in ruins (the world as we know it) adumbrated under the waves while an ark, watched over by angels, perches providentially on Ararat.

As to the character of the present earth, the perigee of the historical cycle, Burnet asks for no more than a duly impartial eye. He concedes that in certain tracts and regions it seems handsome and regular enough, “yet if we consider the whole surface of it, or the whole Exterior Region, ’tis as a broken and confus’d heap of bodies, plac’d in no order to one another, nor with any correspondency or regularity of parts.” He compares it with the moon seen through a good telescope. “They are both in my judgment the image or picture of a great Ruine, and have the true aspect of a World lying in its rubbish” (book 1, chap. 9, p. 91). Later, speaking of volcanoes and earthquakes, he adds, “The truth is, our Cities are built upon ruines, and our Fields and Countries stand upon broken Arches and Vaults, and so does the greatest part of the outward frame of the Earth, and therefore it is no wonder if it be often shaken” (book 1, chap. 9, p. 98). He points to the clearest legacy of the catastrophic collapse, “the Chanel of the Ocean,” a monstrous deformation that could not have been in the original frame of nature. “When I present this great Gulf to my imagination, emptied of all its waters, naked and gaping at the Sun, stretching its jaws from one end of the Earth to another, it appears to me the most ghastly thing in Nature. What hands or instruments could work a Trench in the body of the Earth of this vastness, and lay Mountains and Rocks on the side of it, as Ramparts to enclose it?” (book 1, chap. 10, p. 102). In the presence of the scale, deformation, and irregularity of this face of nature, Burnet feels—but without the exhilaration of his Romantic successors—all the terrors of the sublime.

Nor is it the greatness only, but that wild and multifarious confusion which we see in the parts and fashion of it, that makes it strange and inaccountable; ’tis another Chaos in its kind, who can paint the Scenes of it? Gulfs, and Precipices, and Cataracts; Pits within Pits, and Rocks under Rocks, broken Mountains and ragged Islands, that look as if they had been Countries pull’d up by the roots, and planted in the Sea.

(book 1, chap. 10, p. 104–105)

Burnet is less certain of the natural forces that will produce the conflagration of the world, still to come, but is sure that that smelting process will lead to a refinement and restoration. He imagines a concatenation of dwindling surface waters, massive and simultaneous volcanic action, the ignition of underground mineral fuels, and fiery meteors and exhalations, all encouraged by the cavernous state of the current ruin. His sweeping account of the universal conflagration makes graphic use of the imagery of war, Hell, and nature’s lesser catastrophes. It will end

in a Deluge of fire: Or, in a Sea of fire, covering the whole Globe of the Earth. For, when the exterior region of the Earth is melted into a fluor, like molten glass, or running metal; it will, according to the nature of other Fluids, fill all vacuities and depressions, and fall into a regular surface, at an equal distance, every where, from its center. This Sea of fire, like the first Abyss, will cover the face of the whole Earth: make a kind of second Chaos: and leave a capacity for another World to rise from it.

(book 3, chap. 12, pp. 305–306)

In Burnet’s elaboration of the process, the result of the melting of the cities, the mountains, and the great land masses that bore them is a core that remains solid under a region of molten matter, surrounded by volatile matter, which, “all mingled together, of different sizes, figures, and motions, will constitute an opaque Cloud, or thick region of

darkness round the Earth.” It is this outer region, “or all above that Orb of fire,” which is crucial to the next stage, and it is “the true draught of a Chaos: or a mixture and confusion of all the Elements, without order or distinction. Here are particles of Earth, and of Air, and of Water, all promiscuously jumbled together, by the force and agitation of the fire.” Then, when the force ceases, they will settle and separate “according to their different degrees of gravity,” forming a shell over the abyss much as in the first precipitation from chaos, reconstituting the “Paradisiacal World.” “Nature here repeats the same work, and in the same method; only the materials are now a little more refin’d and purg’d by the fire.” Also, Earth’s axis, shifted in the catastrophic imbalances at the time of the crustal collapse, would now reform in a right relation to the ecliptic plane (book 4, chap. 2, pp. 323–326).

The featureless millennial world of the sixth phase in Burnet’s frontispiece illustration, a world populated by the resurrected just, is also due to pass away in a final consummation. Burnet says he finds not much guidance in Scripture, and little in the philosophers, concerning what then follows, though there are suggestions of a refined fire or ether in the Stoics, which he traces back to Heraclitus, Orpheus, and

the Sages of the East.... But this dissolution of the Earth into Fire, may be understood in two ways; either that it will be dissolv’d into a loose flame, and so dissipated and lost as Lightning in the Air, and vanish into nothing; or that it will be dissolv’d into a fixt flame, such as the Sun is, or a fixt Star.

Burnet is of the opinion it will be the latter, admittedly on slender evidence, and that is what the image of rectified fire and light in the seventh circle is intended to represent. Burnet suggests that the planets were once fixed stars, and if so, “their revolution to the same state again, in a great circle of Time, seems to be according to the methods of Providence; which loves to recover what was lost or decay’d, after certain periods” (book 4, chap. 10, p. 376). And his frontispiece shows the Creator standing, one foot planted on the ancient chaos, another on the earth in its apotheosis, less like the liminal Janus, embodiment of chaos and lord of transitions, than as the Closer of all Circles, architect of the drama, watched by the symmetrical, unpolarized, and nondirectional choirs. “There,” says Burnet, “we leave it”—he has got fond of his chief character, the Earth: “Having conducted it for the space of Seven Thousand Years, through various changes from a dark Chaos to a bright Star” (book 4, chap. 10, p. 377).

Burnet is a Janus figure himself, in that traditional concerns inform his physical approach. Accordingly, Burnet’s universe differs from Newton’s in several important respects. It is fundamentally historical and evolutionary, even if its temporal course is circular; chaos is incorporate in its ongoing processes, rather than being relegated to a condition external to the mechanism of the world; and it offers explanation by way of observable geological phenomena. In these differences are foreshadowed the divergences between geological science (with its dependent, evolutionary biology) and planetary and solar physics, which rose to a brief climax and impasse in the nineteenth century. Burnet’s chaotic processes would also find an echo in the poetic catastrophism of that later era, as in Byron’s 1821 cosmological drama *Cain*.



# THE HOMEOSTATIC UNIVERSE

Only the first two books of Burnet's Sacred Theory, explaining the present-day earth in all its irregularity, were delivered to Newton before their publication. Newton responded with comments, and in one lengthy letter he offers his own account of the "Mosaical chaos" and the Creation, shifting focus from the earth to the solar system as a whole. Newton supposes all the planets created together. "That they & ye sun too had at first one common Chaos. That this Chaos by ye spirit of God moving upon it became separated into several parcels each parcel for a planet." He also tactfully suggests mechanisms whereby the earth could have come by its mountainous-oceanic irregularity at the start, mechanisms that would eliminate the need for Burnet's perfect sphere of the antediluvian phase and the catastrophic bursting and implosion of the shell. From chemical action—as in saltpeter crystallizing in long bars out of a uniform solution or molten tin when it congeals—he draws his example for how "an uniform chaos [could] coagulate at first irregularly in heterogeneous veins or masses to cause hills," and he adds, as a homely afterthought, "Milk is as uniform a liquor as ye chaos was. If beer be poured into it & ye mixture let stand till it be dry, the surface of ye curdled substance will appear as rugged & mountanous as the Earth in any place."<sup>15</sup> It is clear that the notion of chaos as a precosmic state offers no difficulties for Newton the scientist or the Christian but that, once the solar system is in operation, he finds eruptions of chaos unnecessary and unwelcome. The machine once set going might need an occasional tuning up, but the general laws that express its architecture and action are not framed to incorporate intrinsic instability, an inherent principle of disorder.

By the end of the eighteenth century, natural philosophy had managed to squeeze out the last pockets of chaos in the mechanical system of the world, notably by rigorous mathematical analysis, culminating in the work of Lagrange and Laplace. By 1787, Laplace had shown that all apparent aberrations in the motions of the planets and the moon were periodic and in fact served to stabilize the system rather than to disrupt it cumulatively. He could write, in his account of this homeostatic "world system" (1796), "It is certain that the elements...are organized in such a way that it necessarily enjoys the greatest stability, so long as no external causes [causes étrangères] come to trouble it." As with the fluctuation of the tides on the earth and as with the position of the poles, so with the planets and their satellites: "the stability of this system is yet another consequence of the laws of motion."<sup>16</sup> Further, in the light of his own (and Kant's) exceedingly plausible hypothesis whereby the system could evolve from a nebular origin into its present stable arrangement as "an effect of the laws of motion," Laplace could dispense with Newton's resort to an intelligent and all-powerful being to justify the planetary mechanism and its original organization out of chaos (443). As Laplace saw it, Newton had pushed the need for involving "final causes" as explanation "to the limits of the solar system." Now natural philosophy had pressed well beyond those limits and in the process rid itself of the need for either a primal or subsisting chaos outside nature's general laws and arrangements. Nevertheless, already in Laplace one finds the unmistakable dissociation between the fate of the solar system—that is to say the fate of man—and the fate of the universe, a dissociation that was to haunt the imagination and furnish the subtext of the heated disputes between physical and biological

standpoints in the nineteenth century. On the one hand—admiring the effect of gravity in establishing and sustaining the beautifully related movements of Jupiter’s moons and in stabilizing the annual periods, the axial inclinations, and thus the seasons on each planet—Laplace observes: “It seems nature had arranged all in the heavens to assure the duration of the planetary system, through motives similar to those that she appears to us to follow so admirably on earth for the preservation of individuals and the perpetuity of species” (442). But on the other hand, noting the likelihood of some nongravitational mechanical resistances in space and the inevitable diminution of the mass of the sun through emission, he asks,

But so many species of extinct animals whose organization Cuvier was able to recognize with rare sagacity in the numerous fossil bones he described, don’t they show a tendency in nature to change even those things that are apparently most fixed? The magnitude and importance of the solar system should in no way make it an exception to this general law, since they are relative to our littleness; and this system, vast as it seems to us, is a mere insensible point in the universe.

(443–444)

The burden of indifference in the universe at large, amid innumerable suns and systems of suns, to the passing of a local system, and the associated tension between celestial mechanics and universal physical tendencies, would be felt in an even acuter form on the other side of the age of revolutions.

Meanwhile, it was the completion of the Newtonian system, as a timeless structure constituted and conserved through motion, that captured the imagination and offered useful paradigms for the world and activities of man. The emotional appeal as well as the intellectual force of the inertial, homeostatic model, where “the laws of motion” themselves assure stability, are manifest in a wide range of intellectual and cultural products, from Pope’s couplets to the political economy of Adam Smith and the population dynamics of Malthus. A full two decades before his *Wealth of Nations*, Smith had shrewdly noted,

Systems in many respects resemble machines. A machine is a little system, created to perform, as well as to connect together, in reality, those different movements and effects which the artist has occasion for. A system is an imaginary machine invented to connect together in the fancy those different movements and effects which are already in reality performed.<sup>17</sup>

But in the same incomplete work, a “History of Astronomy,” Smith concludes with a veritable ode to Newton. Smith’s argument has been that philosophical systems are “mere inventions of the imagination to connect together the otherwise disjointed and discordant phaenomena of nature,” or, as he says in another place, “to introduce order into this chaos of jarring and discordant appearances.” But the scope, solidity, explanatory and connective power, and subsequent empirical vindications of the Newtonian “machine” lead him to ask,

Can we wonder then, that it should have gained the general and complete approbation of mankind, and that it should now be considered, not as an attempt to connect in the imagination the phaenomena of the Heavens, but as the greatest discovery that ever was made by man, the discovery of an immense chain of the most important and sublime truths, all closely connected together, by one capital fact, of the reality of which we have daily experience?

(45–46, 105)

Smith was distinctly skeptical of the utility of applying systems originating in one sphere of discourse to phenomena belonging to another (46–47). But in an intellectual climate so dazzled and dominated by the Newtonian model, it is not surprising that the reciprocities of supply and demand in Smith's later rationalization of the chaotic phenomena of "wealth," like Malthus's positive checks, would smack of the Newtonian principles of action and reaction and the composition of forces. The self-regulatory mechanisms of a system of free exchange and capital accumulation and consumption—where inertia takes the form of every agent's disposition to pursue his own interest and gravitation plays the role of the "hidden hand"—gained plausibility from the solar system.

## FRICTION AND NOISE

No age is monolithic, and any powerful paradigm in a culture is bound to encounter, even generate, resistances. The Newtonian world system was a conservative system whose bent was to persist inertially, subject only to untoward foreign intrusions or to ill-defined slow-acting resistances. The latter were hard to specify, but in a terrestrial setting the most important went under the name of "friction."<sup>18</sup> "For FRICTION," wrote Christopher Smart in *Jubilate Agno*, his prayerful catalogue of creation (1759–1763), "is inevitable because the Universe is FULL of God's works."<sup>19</sup>

The resistance to the paradigm of the inertial system of the world took many shapes, often reflecting some ambivalence toward the model rather than an outright rejection. While the age celebrated a mechanical model that by design or by nature annulled chaos and appeared to include the dynamic in the static, ambivalence often expressed itself by acknowledging the persistence of chaos in local systems. Hogarth offers a case in point. Like the eighteenth-century inventors of the English garden and park, Hogarth thought nature had no use for straight lines and argued the serpentine "line of beauty," something closer to the "true" dance of the planetary system as seen from Earth but not yet the beauty of a true wilderness. Chaos, however, which plays a large part in the content of Hogarth's representations, was not in the mere avoidance of Euclidean diagrams. Chaos in Hogarth is controlled by the means of art, as the chaotic geometry in his clever demonstration plate on the errors of perspective would suggest, and the means of art include the compensatory systems embodied in his narrative structures. In his major pictorial series, starting with *A Harlot's Progress* (1731) and reaching to *Marriage à la Mode* (1745) and *Industry and Idleness* (1747), chaos is contained by a narrative trajectory where inertial motion is the premise and every action has its compensatory reaction of reward or retribution. Elsewhere, a kinetic chaos, moral and physical, like *Gin Lane*, is set in counterpoise to *Beer Alley* and thereby contained and made meaningful, as are the careers of the Idle and Industrious apprentices by their contrastive pairing. Each generates and limits its reciprocal in a self-sustaining moral and social system. Yet it is the agents and representatives of disorder who tend to be most alive, even where savagely caricatured. And among many scenes of disorder, a number are more subversive of system than sustaining—such as *Strolling Actresses Dressing in a Barn* (1738)—while at least one

scene expresses pure delight in the disruption of insipid harmony by chaos at full blast. This is the print titled *The Enraged Musician* (1741, [fig. 6.2](#)), a representation of chaos as polyphonic cacophony, or noise. Though as a representation it is paradoxical in its mere visuality, it is the pictorial analogue of the nonsense words (like “hubbub,” “brouhaha”) that so often represent chaos as pandemonium. In the print, the diversity and multiplicity of the noise makers (street musicians included), all independent of the others, allow for no connecting principle, and the pandemonium that results generates no equivalent opposite force; nor does it suggest inclusion in some higher music that can subdue its incoherent dissonance.



FIGURE 6.2. William Hogarth, *The Enraged Musician* (1641). Engraving, 2nd or 3rd state.

Source: Metropolitan Museum of Art, New York. [www.metmuseum.org](http://www.metmuseum.org).

Both chaos tamed by the means of art and art undone by the forces of chaos, chaos mastered and chaos unleashed, could dramatize resistance to an inertial system. In Hogarth both narratives are pursued, and they are finally complementary. But as the two sides of an ambivalence by no means comfortably resolved, each found a voice as the century progressed—one in words and one in music—that on the one hand launched a brilliantly subversive challenge to the prevailing wisdom sanctioning inertial stability over kinetic disorder and on the other brought to a monumental climax the paradox of chaotic representation in art. Such developments inevitably implicated the very means of art as a self-contained, intelligible system of signs.

The two works in question are Laurence Sterne’s anomalous fiction *The Life and Opinions of Tristram Shandy, Gentleman*, published piecemeal between 1759 and 1767, and Haydn’s great oratorio *The Creation*, specifically the opening section, an evocation of chaos, which premiered in Vienna in 1798.<sup>20</sup> Haydn’s version of chaos in sound is by no means the cosmic equivalent of Hogarth’s streetside cacophony. Rather it reconciles itself



to Newton's century by virtue of its ultimate musicality, meaning also its intelligibility. It finds the means in art both to express and to contain the chaos. Yet it goes further than Newton and the Newtonians would perhaps care to, in opening a vista on both chaos and cosmos as formative states and as reciprocals in an affective continuum. On the other hand, Sterne's extravagant fiction in the guise of an autobiographical narrative is profoundly subversive of the Newtonian order, offering a comedic refutation of the hypothetically frictionless workings of the clockwork universe, of the ambition to reduce complexity to an underlying geometry, and of the authority of system itself. A compendious fragment that flaunts its erratic course and its intrinsic incompleteness, its answer to the question, "Where is there room for chaos in the post-Newtonian universe?" is "Everywhere."

If *Tristram Shandy* is perfect anything, it is a perfect illustration of what friction does to ideal inertial systems, registered in the ever-increasing gap by which the narrative lags its ostensible subject. A year after beginning his chronicle, and now in the middle of his fourth volume, Tristram interrupts himself to point out that he has so far got no further than the first day of his life. Since every succeeding day is liable to require as much description as the first, "at this rate" he observes, "I should just live 364 times faster than I should write" (chap. 13).<sup>21</sup> Not only can he never hope to overtake himself; he must inevitably fall further and further behind. Moreover, while his life continues inertially, its description—and for that matter its actual course, which now involves unwinding the narrative thread—is subject to intrusions and perturbations, digressions and epicycles, considerably at odds with the uniformity and the rectilinear and orbital regularity of Newton's laws and the system they ostensibly govern. The result is charted in Tristram's well-known illustration of his narrative movement to date: (fig. 6.3, from vol. 6, chap. 40). As Tristram says elsewhere, "The machinery of my work is of a species by itself; two contrary motions are introduced into it, and reconciled, which were thought to be at variance with each other. In a word, my work is digressive, and it is progressive too,—and at the same time." He points out its difference from "the earth's moving round her axis, in her diurnal rotation, with her progress in her elliptick orbit which brings about the year" (though he owns the double motion suggested by the thought), since in the case of his book, "Digressions, incontestably, are the sunshine;—they are the life, the soul of reading;—take them out of this book for instance,—you might as well take the book along with them;—one cold eternal winter would reign in every page of it." Consequently, he has "so complicated and involved the digressive and progressive movements, one wheel within another, that the whole machine, in general, has been kept a-going"—and may be kept going for the next forty years (vol. 1, chap. 22).

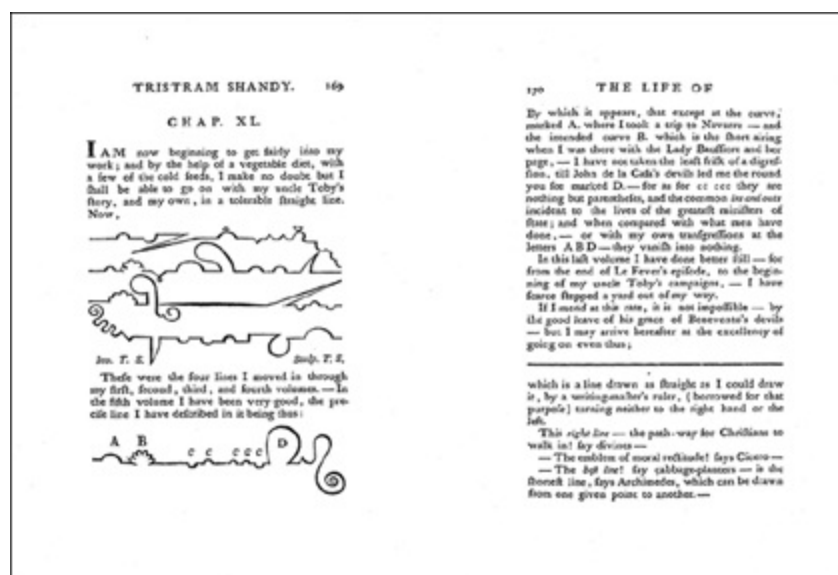


FIGURE 6.3. Narrative-line representations, in Laurence Sterne's *The Life and Opinions of Tristram Shandy, Gentleman*, book 6 (1761).

Locating the energy, that is, the life, in what is erratic and unpredictable, in the excrescences and intrusions, makes Sterne's novel into an antisystem hostile to hypothetical constructs whose chief beauty is their timeless and uncluttered geometry, an antisystem resistant to motions whose chief virtue is their undeviating regularity. The devastating question put to Mr. Shandy in the midst of his clockwork carnality on the night of Tristram's conception—"Pray, my dear, quoth my mother, have you not forgot to wind up the clock?"—does more than illustrate the workings of the worn tracks of mental association in Mrs. Shandy. The incident offers what is practically the first word, and metaphorically the last, on the novel's relationship to systems, especially those that offer to reduce the naturally digressive and unpredictable to a frozen cyclical regularity in a model of mechanical perfection. As for what occasions the disruption, one has to ask whether Sterne might not have been struck by the anticipatory Shandyism in Samuel Johnson's dictionary definition of 1755: "Friction, the resistance in machines caused by the motion of one body upon another."

The energy of *Tristram Shandy* is in the unpredictability of the narrative and the instability of the interpretive matrix—like the language itself, multiplying possibilities rather than narrowing and fixing them. It lies also in the fixations of the inhabitants of Tristram's world, whose mental systems and carnal interests rub against one another in what appears to be a universal tendency in the real world to be at cross purposes. It is an energy of condition rather than of direction, digressing as it progresses, produced (as it seems) almost inadvertently, from the accidentals. It runs counter to all essentializing, reductive systems and as such offers a ludic intimation of the transvaluation that, in some of Sterne's successors, would find in chaos a positive virtue and would identify chaos with the liberating and transformational potential in an unconditioned energy let loose upon the world.

In contrast, Haydn embeds his rendering of chaos within a recursive order implicit in an existing formal language pressed to the extreme. The complex representation that results unsettles but is not in the end incompatible with the mindset that takes comfort in the kinetic stability of the Newtonian world. In achieving such inclusiveness, Haydn offers a no less

ambitious but in the end more conservative program than Sterne, who valorizes the tissue of resistances and whose fictive representation challenges the existing formal language, challenges its capacity to contain the chaotic without itself succumbing to chaos. By extension—in Sterne but not in Haydn—the capacity of any systematized representation to contain the full experiential reality is put in doubt.

Haydn's *The Creation* begins with an introductory section, an *Einleitung* titled, in first publication, "Die Vorstellung des Chaos," a "setting forth" of a chaos that begins in C minor and, after many vicissitudes, is finally resolved and displaced by the great C major chord that bespeaks light.<sup>22</sup> Haydn's astonishing treatment of this prior stage of *The Creation* can be thought of as having two functions, one evocative and as such representational, the other musical, fulfilling the requirements and seizing the opportunities in the current state of the art. To evoke chaos, Haydn creates an impression of vast, slow-moving amorphousness, using unresolved harmonic progressions and fragmentary motifs that evade completion and seem to lose themselves in one another. His means, however, remain musical. That is, he does not resort to noise—random admixtures from throughout the audible range whose clashing and unlovely promiscuity would bespeak disorder in the realm of sound, as it does, for example, in Monteverdi's *Orfeo* (1607). There, the master-musician's victory over death and darkness through his persuasive harmonies is annulled when—hard upon his ambulatory song of triumph and subsequent anxieties resolved—the stage direction appears, under a blank (musicless) section of the staff, "Qui si fa strepito dietro la tela" (Here there is a noise behind the backcloth).<sup>23</sup> Again, in Ben Jonson's *Masque of Queens* (1609), the allegorical hags of the introductory antimasque enter "all with spindles, timbrels, rattles or other venefical instruments, making a confused noise, with strange gestures." They intend to:

...blast the light;

Mix hell with heaven, and make Nature fight

Within herself; loose the whole hinge of things;

And cause the ends run back into their springs

—in other words, to reinstate chaos, invoked and represented by noise, in a theatrical form where music and dance, "numbers" (verse) and spectacle, are intended above all to celebrate and inspire the harmonious order of the realm.<sup>24</sup> Music, by virtue of harmonious relationships translatable into number, was thought to express and indeed to embody the order and architecture of the universe from the Pythagoreans onward, verging on the literal in such inventions as "the music of the spheres."<sup>25</sup> Noise was the sound of ruin and destruction, of conflict, impermanence, universal disarray. It is noise that negates the perception of coherent structure, not silence. As David Hockney observed, speaking of his deafness, "It is not so much a descending silence as expanding confusion. Deafness is a noisy babble of chaos."<sup>26</sup>

Noise was external to the Western idea of music before the twentieth century, as dissonance was not,<sup>27</sup> and the role of dissonance in music proved a fertile source of analogy for those who would find the continuing eruption of disorder in the universe no argument against its systematized perfection. So Leibniz, who sought in the metaphor of "a

preestablished harmony” the solution to apparent discontinuities (as between God and the working cosmos, or the mind and material reality), also argued that “there are cases where some disorder in the part is necessary for producing the greatest order in the whole” and further that “even a dissonance in the right place gives relief to harmony.”<sup>28</sup> Indeed, the dissonances are there to be resolved, integral to the system, governed by the same aesthetics that governs the system of music: “Great composers very often mix dissonances with harmonious chords to stimulate the hearer and to sting him, as it were, so that he becomes concerned about the outcome and is all the more pleased when everything is restored to order.”<sup>29</sup>

In his “Representation of Chaos,” Haydn uses dissonances—a relative matter in a harmonic system resting on key—but avoids those prepared releases of tension “when everything is restored to order.” Here order is not to be restored but created. In so using dissonance, Haydn is certainly more subtle, and arguably more “musical,” than one nevertheless remarkable eighteenth-century predecessor, Jean-Féry Rebel. In a much admired balletic *simphonie*, *Les élémens* (1737), Rebel began his representation of “le Cahos” with the simultaneous sounding of every note in the D minor scale—an effect that must have struck contemporaries as fully qualified noise.<sup>30</sup> Rebel then depicts his chaos as the four elements, with their distinctive characteristics struggling, in diverser reprises, “to extricate themselves [se débarasser] one from the other,” the struggle diminishing as they approach the ordered, disentangled harmony of the enduring cosmos. In an *Advertissement* of the program of the music and his intentions, Rebel states that “the introduction to this *Simphonie*...is Chaos itself, the confusion that reigned between the Elements before the instant when, obeying unchanging laws, they had taken the places assigned to them in the Natural order.” He indicates how each element is characterized, both by instrument and descriptive quality, so that each “can be recognized, separated or intermingled, in all or in part.” Conscious of stretching the bounds of what the system of music with its own understood laws could include, he has attempted to bridge representational and musical function. He observes, “I have dared to undertake to join to the idea of the confusion of the Elements that of the confusion of the harmony. I have tried to have heard at first all the sounds mixed together, or rather, all the notes of the Octave united in a single sound.” These notes then develop, climbing in concert “in an altogether natural progression, and, after a dissonance, one hears a perfect chord.”<sup>31</sup> Once the system, that is, the cosmos, is constituted, with all the elements in their assigned places obeying unchanging laws, the dance of the elements may proceed with nothing left over to challenge the framework of order, whose choreographed relations had long since found analogy in the metaphor of the dance.<sup>32</sup>

The logic of representing chaos by musical means was a critical issue in the reception of *The Creation* almost from the first, and it still triggered a defensive reflex well into the twentieth century.<sup>33</sup> A much noted criticism from 1801, attributed to F. L. A. Kunzen, a musician himself, attacked the very notion of “setting chaos to music. Can there be a more unfortunate idea? All music is in itself order, rhythm. Without them no music is conceivable. A chaos of notes is no music but noise, shouting, racket; and everything that lies beyond the sphere of the beautiful, the idealistic, is lost for art.” He acknowledges that Haydn “has



used all his art to bring forth this chaotic impression,” but Kunzen cannot accept the result.<sup>34</sup> A celebrated and insightful early analysis from Carl Friedrich Zelter, the composer, conductor, and friend of Goethe, acknowledges “the appearance of impossibility and of contradiction” but argues “this marvel is in fact the most poetic and hence the best part of the whole plan,” that out of the raw materials of what musical instruments are capable of, “a gigantic, almost incalculable web of artistic splendour is woven and formed. The objection that Chaos cannot be depicted by means of harmony, melody and rhythm now falls to the ground.”<sup>35</sup>

That Haydn avoids “tone painting,” a mimetic literalism, in evoking the unimaginable has not prevented generations of critics from translating the experience of the music into images. Zelter actually enlists the “peculiar and mysterious look” of the score, with “figures that swarm round huge dark masses, like clouds of insects against the great horizon.” But more to the point, Haydn’s nonliteralism turns verbal descriptions into reports of psychological effect. (Zelter continues, “All these things in combination, in the dark imagery of Chaos, make up an endlessly harmonious fabric, in which the succession of modulations is indescribably beautiful and in many places so sublime and lofty as to invoke awe.”) The analytical problem becomes to understand how Haydn creates such effects musically—that is, how and to what extent he manages to reconcile representational intention and musical function.

The formidable modern Haydn scholar H. C. Robbins Landon notes how Haydn “dematerialized the overall sound” in his chaos introduction from sketch to sketch.<sup>36</sup> Dematerialization of the sound—a curious metaphor in its own right—refers to representational rather than musical function. In one sense, Haydn’s chaos is clearly dematerialized compared to Jean-Féry Rebel’s. In representing the formless void, Haydn eschews characterization of the traditional four elements to generate “chaos” out of their conflict and fragmentation and relies instead on more abstract, indeed, more “musical” means. How Haydn pursues his representational intentions yet manages to satisfy musical function, with which one would expect them to be in some tension, is brought into focus by two divergent accounts from later eras, the first written in a style characteristic of the mid-nineteenth century.

Thomas Damant Eaton, addressing musical means in terms of effect, wrote of “The Representation of Chaos”:

Haydn has availed himself of harmony to paint this state of things. Melody and modulation had savoured too much of order, and here all was to be confusion, yet not unstudied. Listen to the discords, wailing and screaming for resolution. Call succeeds call, yet the concord does not come; when at length it comes, and order seems about to beam upon you, the sepulchral glimmer is extinguished by a series of discords more horrid than before, and night more profound deepens round you. Thus you are led through a labyrinth of sounds, till the scene dissolves in a low faint moan, the key (if key it may be called) being minor.<sup>37</sup>

Eaton suggests how the pointed disservice to musical function, the purposeful flaunting of what (still) to the contemporary ear were the bulwarks of musical order, the grudging concessions that were no sooner allowed than annulled, all contributed to “effect,” or affect, a psychological template for chaos, disorienting and horrific. Effect is primary. Yet, Eaton is clear, this is not mere confusion, not nonmusic, “not unstudied.”

Charles Rosen, the masterful modern expositor of both the Classical and Romantic styles in music, takes another tack. He shows how this evocation of chaos does in fact serve musical function and how, in the end, its representation is subsumed in a higher or more fundamental order, intrinsic, as it were, to constituted being—like gravity and inertia to the systems that rest on their necessary action:

The famous depiction of chaos at the opening of the Creation is in “slow-movement sonata form”: nothing could show better how, for Haydn, the “sonata” is not a form at all, but an integral part of the musical language, and even a necessary minimum for any large statement that can be made within that language. The themes are here reduced to very small fragments, as are the musical paragraphs, but the proportions of a sonata movement without an isolated development section but with articulated exposition and symmetrical recapitulation (both with two regular groups of themes) is as present as ever in Haydn’s slow movements.<sup>38</sup>

If, then, in its representational function, Haydn’s *Einleitung* is contrastive to the order of creation, in its musical function it is incorporate. Further, it is not irrelevant that the classical sonata movement—whether as form or as inescapable syntax, the quintessential structural expression of the great musical style that rose and flourished in the Newtonian system’s heyday—is symmetrically recapitulative. It even could be said that its structure develops out of an elliptical premise, generated like the planetary orbits out of two focal points—thematic groups in a tense key relationship—and it converts movement (or development) to wholeness and stability through its unerring return to first principles (key and theme) or to where motion began.

Yet that is not the end, the sum, of Haydn’s recovery of chaos at the close of the eighteenth century. Nor was it the beginning of his interest in pressing the complacencies of closed form and incorporating disorder in his musical universe. That interest had appeared, for example, in his Symphony no. 60, “*Le Distrait*” (ca. 1775), full of marked discontinuities and reversals; and in no. 64, “*Tempora Mutantur*” (1773), marked by interruptions, lost beats, failed closure. There are affinities between Haydn’s musical intentions in these works and the avant-garde literature of the time, notably Sturm und Drang drama (discussed below).<sup>39</sup> Heinrich Schenker, who pronounced Haydn faithful to the principle that “it is only with its strict principles that art is able to convey the meaning of Chaos,” still found him “committed to stretching the means of his art, to increase the tension to the point that they—mysteriously—suggest the very mysteries of Chaos.” In the end temporality itself, intrinsic to music, is an instrument for stretching the boundaries of form, for effecting change. As Schenker further observes, “music, an art which unfolds in time, is well-placed to reproduce the effect of Chaos: the first tremblings and movements; the first rumbling of dark forces; the becoming, the giving birth; finally the light, the light of day, the Creation!” (97). Haydn’s chaos may be a prologue to the making of cosmos according to the score, but in so far as it is chaos temporalized, it reconnects chaos and process, that is, chaos and creation, while delivering the imaginative experience of boundless drift and suspension. If indeed Haydn found his means in the available musical language, one that subsumed process in form, he did so in a climate where energy and process could dispute the authority of form. After all, the Paris edition of *La création du monde* (1801)—with a frontispiece based on Raphael’s Creator bounding through chaos (fig. 3.2)—describes itself as “Exécuté le 3 Nivose an 9<sup>e</sup>” of the revolutionary calendar.

# NEBULAR HYPOTHESES

The modern critic Donald Francis Tovey, whom it is perilous to ignore, while calling attention to “the elements of the sublime and the romantic” in Haydn’s representation of chaos, thought it harmonized “most closely with the Nebular Hypothesis of Kant and Laplace, which almost certainly attracted Haydn’s attention.”<sup>40</sup> Laplace had published his argument in what Tovey calls “a readable and popular form” just two years before *The Creation*; Kant’s even more radical conception (arrived at earlier and independently) fit particularly well with advanced thought and sensibility in German intellectual circles where Haydn had numerous friends.

Though Kant’s foundational contributions to modern science were written as a philosopher, early in his career he had also written as (in the modern sense) a scientist and in that vein made some notable contributions. He was the first to consider seriously the effects of tidal friction on the period of the earth’s rotation, and perhaps it was only enlarging his geophysical scope when he arrived at the nebular hypothesis to explain the evolution of the visible universe.

Read backward from such evidence as the solar plane within which the planets circulate, all going the same way, the nebular hypothesis served to rehistoricize the Newtonian universe. Lecturing in the 1840s, Hermann von Helmholtz summarized the Kant/Laplace argument (“one of the happiest ideas in science”) as postulating an ancestral “chaotic ball of nebulous matter, of which originally, when it extended to the path of the most distant planet, many billions of cubic miles could contain scarcely a gramme of mass.” Having detached itself from the makings of other star systems with some slow movement of rotation, “it became condensed under the influence of the reciprocal attraction of its parts; and, in the degree in which it condensed, the rotary motion increased, and formed it into a flat disk.” From this disk, nebulous masses at the circumference again detached through the increasing centrifugal force and took on their own rotations, becoming planets and calving satellites. The process, as von Helmholtz saw it, was ongoing, and even for our solar system by no means complete.<sup>41</sup> Or, as Robert Chambers put it in his concurrent, broadly popular *Vestiges of the Natural History of Creation*, out of “a vaporiform chaos” and “a universal Fire Mist” emerged a universe in which “we now know that there is no such thing as rest.”<sup>42</sup>

Kant claimed (in the very title of his treatise) that his nebular hypothesis was consistent with Newtonian principles,<sup>43</sup> though in the end it offered a vision of the universe that displaced Newtonian stability. That is, in place of a cosmos that was all system with nothing left over, whose present inertial/gravitational condition was homeostatic and self-perpetuating, Kant envisaged a universe that incorporated the chaotic principle not simply as antecedent ground but as a constant, inherent in the play of forces and productive of endless, linear change.

In Kant’s historicized account, he projects a primal condition of the total disaggregation of matter through space. Out of this primitive chaos, the universe constitutes itself by dint of attraction and repulsion (inherent forces) and the operation of mechanical laws. But in Kant’s telling, the narrative that brings us to the current universe is just the beginning. In his

dynamic universe, chaos persists as the necessary condition of a living continuity. Chaos is what sustains a temporalized, endless creation though infinite extent. That is, the aggregation and separation that create cosmos are theorized as radiating outward, as attraction and repulsion do their work, so that there is always a frontier of cosmos in the making, always a chaos to be structured in this universe of ours, which is not self-contained but is rather—like the coextensive Supreme Being—unlimited. Kant uncorks an extraordinary, even ecstatic vision in this reasoned and rational exposition, where the dovetailing simplicity of the laws at work and the unimaginable infinite scale, transcending the billions of worlds already visible in the Milky Way and its distant counterparts, bring on the rapture of sublimity. Creation is endless and positive, an expanding evolution toward a completeness (or perfection) never to be attained or even approached. And the process embraces not only chaos but mortality: the burning out of earlier suns, the collapse of systems, which then fall to a center and blast into renewed dispersal. Yet in so doing they reenergize, in what is an always advancing net gain, through time and space and chaos, for the living creation.

Haydn, of course, does not go that far. After “The Representation of Chaos,” Haydn’s Miltonic libretto reverts to the biblical local architecture, shadowed only by threatened Satanic eruption and the Fall. The Kantian vision of an endless creation and endless fecund turmoil is here beyond his scope, but the primary chaotic processes that lead to the first light of cosmos are not. In England, in the earlier 1790s, Haydn visited William Herschel, the great English-German astronomer who was also a serious musician, and their connection seems to have been a warm one.<sup>44</sup> Herschel had been occupied for a number of years with the impassioned study and classification of apparent nebulosities in the heavens. In 1791, he read a paper to the Royal Society explaining an entirely new view, deduced from observation, of the nebulae as the matter out of which stars, in distinct stages, “condensed.” Laplace, presenting his own argument on the evolution of the solar system in his *Exposition du système du monde* (1796), summarizes the stages in Herschel’s progressive account whereby “nebulae are converted into stars” and remarks that “Such a remarkable convergence arrived at by opposite lines of reasoning gives great probability to the existence of this anterior condition of the sun.”<sup>45</sup> It would be strange if, in demonstrating the marvel of his telescopes to an intelligent visitor such as Haydn, Herschel’s special preoccupations would not emerge. Not surprisingly, Herschel was later among the subscribers to Haydn’s formidable first edition of *Die Schoepfung, ein Oratorium in Musik gesetzt* (Vienna, 1800).<sup>46</sup>

Contemporary cosmology, engaged in plotting the path and forces that could produce the universe, was thus plausibly available, both in England and Germany, to a Haydn who, while in England, was inspired to offer his own account of the Creation. And, one might add, science, or natural philosophy, bringing light out of darkness, had a privileged place in the Masonic ideology that influenced Haydn no less than Mozart. Haydn more than once endorsed Zelter’s accounts of his Chaos opening; it should not surprise us that, in an article previous to the one already quoted, Zelter offers a description whose imagery echoes stages in the nebular theory’s formative processes: the transition from randomness to significant, seemingly vortical motion; aggregation and separation; streaming, orbital



definition, star formation:

The Overture describes chaos. A gigantic unisono of all instruments, at the same time a light-less and formless mass, are suggested to our imagination. From it single notes come forth, which in turn spawn others. There are spun forth forms and figures, without line and order, that disappear only to appear again in different guise. Movement begins. Huge forces grate against each other and begin to gestate, and occasionally, as if fortuitously, they dissolve harmonically and then sink back into darkness. A swirling and twisting of unknown forces, which gradually separate themselves and leave clear breaks, announce that order is near. Each flood gradually seeks its proper bed, not without forcing. Here a star moves in its path, there another one. The swimming forces approach land. Similar forms attract each other and embrace. It is night. And God spoke: Let there be light! And there was light!<sup>47</sup>

With light, however, we are no longer comfortably in the realm of pure mechanical forces. When the coming of light no longer marks the dismissal of chaos, so deeply identified with primal darkness, when light appears as uncontained energy not antithetical to but—as in some of Turner’s paintings—fiercely incorporate with chaos, then chaos itself will have changed its sign and nature.

## ENERGY UNBOUND

Energy is that which moves.

—Werner Heisenberg

In an effectively closed inertial system, where motion and rest come to the same thing, it takes effort to effect change—to stop, start, alter course, modify the status quo. Great eruptions or intrusions of energy are to be feared not only as disruptive of local stability but as possibly fatal to the system as a whole. Consequently such eruptions of energy were (and are) regularly identified with the onset of chaos, in thought and representation. But models that neutralize change can lose their universal appeal in a restless society, and as physical science groped toward a reified and generalized concept of energy, broadened beyond mechanical force and the vis viva of mass in motion, it met with an imaginative climate in which energy could be set in fruitful opposition to static equilibrium and liberated from stable form. Energy as an instrument for effecting change, indeed as disruption, could become a value in itself. Energy in the raw—even chaos in the guise of living energy—could be embraced as the positive alternative to mechanical recurrence and persistence, to the dead and deadening hand of inertia.

In the sections that follow, I trace phases in an intellectual revolution consciously valorizing and celebrating flux and energy unconstrained, in the teeth of their association with chaos. In Germany, toward the end of the eighteenth century, an assertive new generation would embrace and subjectivize that association, dramatizing its rough enactment as *Wirrwarr*. It furnishes the rubric of my first section, below. Elsewhere, poets of a radical turn would invoke a rhetoric of reversal, redefining law and limitation, repressive constraint and embodied inertia, as “true” chaos, or in Blake’s apt phrase, “Petrific Chaos.” Blake and Shelley appear under that rubric, both drawing on a radical reading of Milton and in Blake’s case on a fierce critique of the universe according to Newton.<sup>48</sup> The revolution, having declared itself in poetry and philosophy, looked for foundations in science and

history. It is in history—recent history—that Carlyle, saturated in German thought, finds an adequate correlative for a universe of forces subject to no constraints other than their inner dynamic, unpredictable from moment to moment, and erupting catastrophically when blocked from social expression. Carlyle's French Revolution (1837) has to be among the most ambitious attempts at evoking from history the moving, uncontainable force that is chaos, in what deserves to be called his "Epic of Energy."

Meanwhile science and history found the means once more to qualify chaos into cosmos, though a cosmos now Heraclitean in its dynamism. This is the universe emergent in the thinking of the remarkable scientist Michael Faraday and evoked in the progressively radical art of Joseph Mallard William Turner ("Energy's Image"). Their convergence testifies to the imaginative reach and fertility of the new century's transformative reframing of chaotic energy. Finally, in a "Postlude" that leaps to the twentieth century, I call on the Italian Futurists, who proclaimed themselves energy's acolytes and as such promoters of disruptive chaos by word and deed. That they simultaneously embraced the machine as epitomizing all that was dynamic in the modern world is an irony, given the Romantic origins of their creed in a repudiation of the mechanistic universe, where energy was bound, like Prometheus, in the adamant chains of an inertial system and a mechanical homeostasis.

## WIRRWARR

Both the reification of energy and the transvaluation of chaos have roots in the age of revolutions—political, economic, and industrial—and speak in its art and aesthetics. They are there linked with a striking feature of the so-called Romantic Century, from Rousseau and Burke forward: an animus toward artifice and a suspicion of system itself. These appear in both revolutionary and counterrevolutionary rhetoric. In art and aesthetics they speak in the rejection of genre decorum, the privileging of content over form, the cultivation of the fragmentary and the incomplete, the elevation and pursuit of the sublime. For its theorists, the sublime exists in tension with the comfortable pleasures of the beautiful, in contrast with the latter's symmetries, proportionalities, compassable bounds, and purposeful ordering. "Nature excites ideas of the sublime in its chaos or wildest and most irregular disorder and desolation," wrote Kant.<sup>49</sup> The aesthetics of the sublime meant that the violent action in fire and storm, the vertiginous disregard of human scale in overwhelming height, mass, depth, extent, desert and mountain, glacier and abyss, transferred their perceived qualities to the experiencing subject—as ego-annihilating threat or uncontainable rapture, as an affective kinesis, in contrast to the static and self-contained repose of beautiful form.

In taking up the materials that he would by stages turn into the supreme emblematic text of the era, Goethe inextricably linked the aesthetic to the philosophical challenge. In *Faust*, part 1, not only does he make manifest the chaotic principle as the spring of the action, but—at this stage of his creative thinking—he offers no synthesizing resolution to the restless contest between chaos and order, in art or the world, and is prepared moreover to declare his party preference. The jottings for his *Faust* plan of about 1800 envisage:

Conflict between Form and the Formless  
Preference for formless content  
Over empty form.  
Content provides form  
Form is never without content.

Such contradictions, instead of uniting them, make them more disparate.<sup>50</sup>

Accordingly, Goethe's Mephistopheles—"Hoar Chaos's fantastic son"—is more than the spirit of negation; he is also an energy whose justifying function is the disruption of the steady-state conditions that are the counterpart of an inertial cosmos and closed form. In the drama's "Prologue in Heaven," God registers approval of the Mephistopheles principle:

Man all too easily grows lax and mellow  
He soon elects repose, at any price;  
And so I like to pair him with a fellow  
To play the deuce, to stir and to entice.<sup>51</sup>

From disruption, change of state, change of direction, endless desire, comes renewal and endless possibility.

A. W. Schlegel makes this the principle of Romantic art. In contrast to antique poetry and art, marked by what he calls "a rhythmical nomos (law), an harmonious promulgation of the permanently established legislation of a world submitted to a beautiful order," Romantic poetry, he declares, "is the expression of the secret attraction to a chaos which lies concealed in the very bosom of the ordered universe, and is perpetually striving after new and marvelous births; the life-giving spirit of primal love broods here anew on the face of the waters."<sup>52</sup> Or, in the gnomic formulation of the poet Novalis (Friederich von Hardenberg): "In any poetical work, chaos should shine through the customary veil of order."<sup>53</sup>

In turning to the materials of the Germanic folk tradition and the juncture of historical and imaginary worlds, Goethe embedded his Faustian fable of positive restlessness and sublime incompleteness in an imaginative realm that, to Novalis also, expressed the inextricable reciprocity of chaos and creation. In the complex mingling of natural and supernatural to make the alternative world of the Märchen, Novalis saw the simultaneous presence and the nested succession of chaos and coherence in a temporalized nature. He writes, in one of the condensed fragments that constitute his finest legacy:

In a genuine fairytale, everything has to be wonderful—mysterious and incoherent—and everything animated [alles belebt]. Each thing as something other. The whole of nature must be mingled in a strange way with the whole spirit world. The time of universal anarchy—lawlessness—freedom—Nature's State-of-Nature—the time before the world... This time before the world delivers, as it were, the diffused features of the time after the world—just as the natural state is a strange image of the eternal realm. The world of the fairytale is the complete contrary of the real (historical) world—and at the same time is as completely like it as Chaos is to the perfected Creation.

In the end, only the symbolic language of mathematics serves to encapsulate the paradox of a chaos that has absorbed and transfigured all meaning:

In the world to come, everything is as in the quondam world, and yet everything is entirely different. The world to come is a rational Chaos—Chaos that has permeated itself, that is both inside and outside itself—Chaos<sup>2</sup> or ∞.<sup>54</sup>

Novalis, partly by dying young, gave considerable impetus to fragment as an alternative to form. His friend, the philosopher Friedrich Schlegel, observed that while “many of the works of the ancients have become fragments” (and have gained in imaginative interest thereby from the rich possibilities evoked by the missing conclusion, the hinted shape, the shattered magnificence, the enigmatic trace of history), “many of the works of the moderns are fragments at their inception.”<sup>55</sup> It was Friedrich Schlegel also who suggested that the ideal Romantic fiction would have the character of a “shaped, artful Chaos,” a description that at least one critic of the narrative turn in the fiction of the age finds proleptically fulfilled in *Tristram Shandy*.<sup>56</sup>

Less rarified dislocations of the aesthetics of equilibration and containment came to the fore in a contemporary art that sought affective kinesis in passion, sentiment, and unconditioned “effect.” Goethe’s earliest *Faust* bore the traces of a clamorous episode in German letters, an affirmation of chaotic energies that accompanied an intense interest in the American Revolution and showed an impatience with the rationalities and trivialities of dominant strains of Enlightenment culture. Karl Kroeber has described Romantic art as producing “what might be called a pluralizing style, or perhaps more appropriately, a maximalist aesthetic.”<sup>57</sup> If ever art deserved the latter characterization, it belonged to the literature of *Sturm und Drang*, a literature that found its most vigorous platform in drama, as the genre most set about with formal constraints and doctrines of decorum but also most intrinsically immediate and kinetic in its theatrical enactment. In addition to enlisting new and daring subject matter, the *Sturm und Drang* impulse can be said to have pressed an existing highly conventionalized drama of the passions and sentiments—regularized and contained in formalized structures and performance styles—beyond itself, infecting the medium, as it were, with the violent agitations, extreme contrasts, and abrupt discontinuities of dramatized sensibilities consumed by feeling and regularly teetering on the edge of madness. Linguistic and dramaturgic syntax erupted imitatively and sought to function expressively. Diction, imagery, and stage action followed suit. The play that gave the movement its name, Friedrich Maximilian Klinger’s *Storm and Stress* (1777), was originally to be called *Wirrwarr*, another of those reduplicative onomatopoetic words—like *hubbub* and *hurly-burly*—for noisy confusion, conflict, chaos. Its prototypical protagonist, “Wild,” a volatile and tormented English nobleman, has come to America, “where everything is new, everything is significant,” to fight and lose himself in the war. He opens the play in heavy weather with the announcement, “In tumult and uproar again, so the senses whirl around like the weather vanes in a storm.” Glorifying in the wild noise and “the obliterating frenzy,” he urges his “Mad heart!” to “Refresh yourself in *Wirrwarr*.” Manic, desperate, “hollow,” trapped in conscious absurdity, he exists for change, escape from the confining limits even of self, even at the cost of annihilation. He declares, famously, “I want to have myself stretched over a drum so as to take on new dimensions. How my heart aches again. Oh, if I could but exist in the barrel of this pistol until a hand blasted me into the air.”<sup>58</sup>

The man whose energies explode the bounds takes another form in Schiller’s sublime melodrama *The Robbers* (1779–1781). Translated and retitled as *Robert, chef de brigands*, its rebel at war with the fixed order of things earned Schiller a diploma of citizenship in revolutionary France signed by Danton and Roland.<sup>59</sup> The play displays all the



extravagances of language and action that mark the style, but it nevertheless manages a critical complexity in its representation of the anarchic principle that finally sets it apart. In a preface to *Die Räuber*, Schiller writes that his outlaw hero, the embittered and charismatic Karl Moor, is “a spirit who finds the worst vice attractive only because of its monumental stature, only because of the Kraft [force, energy] that it demands.”<sup>60</sup> Armed with every power—Schiller observes that he could as easily become a Brutus as a Catiline—Moor complains on his first appearance that, in this modern age of eunuchs, “The bright spark of Promethean fire is burnt out,” and all that is left is lycopodium—the flash and crack of stage lightning. Refusing “to lace my body in a corset and straitjacket my will with laws,” he believes that “the law never yet made a great man, but freedom will breed a giant, a colossus” (191–192). Then, under the lash of a perceived injustice, he responds with a titanic passion. He yearns to sound “the trumpet of rebellion throughout the realm of nature, to stir up earth, sky, and sea, to battle against this brood of hyaenas!” (202). As for the fourth, unnamed element, repeated observations upon his “fiery spirit” as well as comprehensive arson and explosion mark his Promethean track.

But for all his destructive energy and cosmic appetite for rebellion, Karl Moor is not the ultimate agent of chaos in the play. Moor is deeply divided between an aspiration to live heroically and burst through the stifling pettiness of ordinary social life and to live privately in a benign domestic idyll. Schiller sets Karl against his “cold” brother, Franz, whose villainy finds justification in an egoistic materialism where all is itch and advantage. In Schiller’s characterizing preface, Franz “dissolves...reduces...mocks,” having so refined “his understanding at the expense of his heart” that “humanity and heaven amount to nothing in his eyes” (300). Life, as Franz understands it, is a cycle of filth (259) in which “force destroys force. Might is right, and the limits of our strength our only law” (189). When Franz gets the chance, he becomes—with self-conscious relish—an absolutist tyrant. In the world of *The Robbers*, it is the systematic nihilist, not the energetic Promethean rebel, who is the true anarchist.

Karl Moor uses his proclaimed freedoms to inflict vengeance and retribution on society, but as chief of the outlaws he gives away his gains remedially. Both actions are forms of wild justice, looking to a kind of wild order. Shocked by a vision of true anarchy, he recants: “Oh, fool that I was, to suppose that I could make the world a fairer place through terror, and uphold the cause of justice through lawlessness” (296). He sees now “with weeping and gnashing of teeth, that two men such as I would destroy the whole moral order of creation.” In Schiller’s later summation, “Erroneous attitudes toward activity and power, and a plenitude of energy that overflows all law had, of course, to come to nothing as it shattered against civil society” (300). But the deep divisions in Karl Moor, expressed in the difference between his initial challenge to a stifling status quo and his retrospective enthusiasm for order in the light of destruction’s consequences, were by no means confined to the dramatic character. Schiller writes of “the strange Don Quixote who, in Robber Moor, we hate and love, admire and lament.” The plenitude of energy that could overflow stifling barriers, defy oppressive systems, that brought down Promethean fire and could set the stage for something new, resonated profoundly in the divided hearts and minds of both the playwright and his European audience. As Carlyle later wrote of this confused and

exhilarating monster of a play, “The publication of the Robbers forms an era not only in Schiller’s history, but in the Literature of the World.”<sup>61</sup>

In his aesthetic and philosophical writings, Schiller, pressing forward from Kant, articulated most forcibly a Romantic understanding of the sublime. Writing more than a decade after his invention of Karl Moor and in the disruptive but still exhilarating climate of the French Revolution, he locates the sublime in a subjective realm whose absolute grandeur mirrors and transcends the relative grandeur of the sublime in nature, such transcendence of the physical order being the fundamental condition of man’s unconditioned liberty. Accordingly, the mind rising to its full human quality overrides the premises of the Newtonian universe and their putative extension into the moral universe, and ultimately into a mechanical ordering of the social and political realms as well, the sphere of action and choice. Instead, such a mind actually embraces phenomenal chaos:

In the same manner as for the observant traveller, the strange wildness of nature is so attractive in physical nature—thus, and for the same reason, every soul capable of enthusiasm finds even in the regrettable anarchy found in the moral world a source of singular pleasure. Without doubt, he who sees the grand economy of nature only from the impoverished light of the understanding; he who has never any other thought than to reform its defiant disorder and to substitute harmony, such a one could not find pleasure in a world which seems given up to the caprice of chance rather than governed according to a wise ordination.

He urges willing renunciation of “the pretension of restoring this chaos of phænomena to one single notion,” since

just this want of connection, this anarchy, in the phænomena, making them useless to the understanding, is what makes them valuable to reason. The more they are disorderly the more they represent the freedom of nature.... Liberty, with all its drawbacks, is everywhere vastly more attractive to a noble soul than good social order without it—than society like a flock of sheep, or a machine working like a watch. This mechanism makes of man only a product; liberty makes him a citizen of a better world.<sup>62</sup>

As Schiller brings the untamed chaos of nature to bear on the constraints of contemporary society, worn pastoral metaphor (society like a flock of sheep) gives place to modern manufacture, and the negative imagery derived from the clockwork universe becomes a challenging anticipation of the discourse of alienation and social construction in the coming age of the machine.

## PETRIFIC CHAOS

Promethean fire—energy and rebellion in one—became a master trope in the transvaluations that saw in stable systems inertially hostile to change an institutionalized disorder and in disruptive, energetic chaos the promise of a dynamic, open order, one of maximal freedom and perpetual becoming. In Shelley’s *Prometheus Unbound* (1820), written in the chill that followed the age of revolutions and the defeat of Napoleon, it is as a sole remaining threat to the permanence of Zeus’s fixed, monocentric universe that Prometheus is chained to his Caucasus rock and tormented. But it is by a change of mind—not physical force but mental energy—that Prometheus dissolves the mind-forged manacles that hold him, breaks free of Olympian Zeus’s coercive system and delusive power, and

transforms the living world. Mary Shelley, on the other hand, in *Frankenstein* (1818), turns the tables on her “Modern Prometheus,” in a parable where he who gives the vital fire, Victor Frankenstein, becomes the unloving god to his rejected and embittered creation, who in turn becomes a prodigy of rebellious energy and Promethean defiance. Such destabilization of roles in the relations of order and chaos found direct expression in Percy Shelley’s response to the Peterloo Massacre (1819), *The Masque of Anarchy*, which casts the God of the status quo as true Anarchy in a mask:

And he wore a kingly crown;  
In his grasp a sceptre shone;  
On his brow this mark I saw—  
“I AM GOD, AND KING, AND LAW!”<sup>63</sup>

A more complex conception underlies Shelley’s *Hellas* (1821), celebrating the persistence of a spirit of freedom in ages of “Tyranny which arms / Adverse miscreeds and emulous anarchies.” This allows the choral voice to imagine a new dawning of universal liberation, as when,

In the great morning of the world,  
The Spirit of God with might unfurled  
The flag of Freedom over Chaos,  
And all its banded anarchs fled.<sup>64</sup>

Anarchy’s mantra in Shelley’s *Masque*—reiterated by his sycophants—was anticipated by William Blake’s *Urizen*, a Newtonian demiurge whose shaping will would, if it could, bind what is moving and changing, fix what is fluctuating and various, to:

One command, one joy, one desire,  
One curse, one weight, one measure,  
One King, one God, one Law.<sup>65</sup>

In the visionary reversal that locates true anarchy in procrustean order, Blake identifies *Urizen*, bent on the fanatical reduction of the life of things to measure, rule, and system, with “petrific, abominable chaos,” along with his incipient realm, the self-actualized void (I, para. 5).

More than any other artist, Blake deserves to be called the poet of energy. If other imaginative writers of the late eighteenth century pitted restless energy against suffocating order, they generally did so without conceptualizing energy as other than an attribute. But energy in Blake is fully conceptualized, as it soon would be in the developing discourse of contemporary science. Expressed as imagination, it is the fundamental principle that unites social, political, and psychological phenomena with the physical world. The scholar who has written most cogently about Blake and energy, Morton D. Paley, notes that “Blake was the first critic of civilization to endorse the subversive nature of the claims of energy,” and energy was to be “the redemptive force” in what Paley calls Blake’s ethic of liberation.<sup>66</sup> Inevitably, energy is the life of revolution, breaking bounds and upsetting systems. That its actions could be indiscriminately brutal, its redemptive force perverted into new

oppressions, was the knowledge through experience with which Blake had to come to terms, like others of his generation who saw the ethos of liberation overtaken by revolutionary history. Nevertheless, it can be argued that all Blake's subsequent development was rooted in a vision of reality that redeemed the chaos systematically squeezed out of the Newtonian universe and that replaced fixed inertial stability and mechanical system with the transforming dialectics of energy.

Blake's alternative vision is powerfully condensed in his scriptural pastiche from the hectic culminating days of the French Revolution, *The Marriage of Heaven and Hell* (1793). "The Argument" begins by announcing revolution and offers in verse a parabolic history of expropriation to explain that same reversal of positive and negative signs that Shelley allegorized thirty years later in *The Masque of Anarchy*. What follows, however, provides the conceptual framework for a dynamic universe founded on the momentous principle that "Without Contraries there is no progression." The poem identifies the mistaken dualism derived from that principle and enfeebling it, as: "what the religious call Good & Evil. Good is the passive that obeys Reason. Evil is the active springing from Energy," the latter from the body, the former from the soul. Instead, Blake—in "the Voice of the Devil"—offers his countertruth to those doctrines inscribed and immobilized in sacred texts and codes. He affirms that "Man has no Body distinct from his Soul" and that "Energy is the only life, and is from the Body; and Reason is the bound or outward circumference of Energy"—that is, not its positive limit but the horizon of its current reach. Energy, moreover, is "Eternal Delight," and as Blake here and elsewhere makes us understand, its twinned partner in kinesis is desire.

The final inclusion in Blake's *Marriage of Heaven and Hell*, "A Song of Liberty," completes the opening argument and celebrates "a new born fire," a wonder and a terror that "stamps the stony law to dust, loosing the eternal horses from the dens of night, crying: / EMPIRE IS NO MORE! AND NOW THE LION & WOLF SHALL CEASE"—language that appears again in Blake's revolutionary "prophecy" *America* (1793). In the group of prophetic narratives that followed, the nameless agent of the "Song of Liberty" reappears in various guises, in shifting Promethean and demonic relations to apocalyptic release and putative order. As in *The Marriage of Heaven and Hell*, energy is shadowed by its "circumference" reason, and reason is reduced to a "ratio," a formula for gauging or fixing knowledge and experience in its current state. In Blake the artist's visual representations, the memorable images of Urizen (as "The Ancient of Days") and of Newton equip them with the same instrument of measurement, a pair of dividers, seeking to generate from ratio a universe circumscribed in eternal law. But in Blake's dynamic universe, the living principle is not a balanced product of reason's dialectic with energy. Rather, it lies one-sidedly in energy, as a positive force, acting against its true contrary, the passive resistance that would annul change. In a regenerated life there would be no such contraries, and energy itself—uninhibited impulse and imagination—would constitute a natural order. Stasis is not order, and for Blake all static ideas of order are false—willful imposition or mere delusion—Newton's especially. In such a world, "order" becomes its opposite: petrific chaos.



# ENERGY'S EPIC

Close to the midpoint of Carlyle's great work, *The French Revolution: A History* (1837), he pauses to reflect upon "the All" in which his local epic unfolds. He writes:

Our whole Universe is but an infinite Complex of Forces; thousandfold, from Gravitation up to Thought and Will; man's Freedom environed with Necessity of Nature: in all which nothing at any moment slumbers, but all is forever awake and busy.... indeed, what is this Infinite of Things itself, which men name Universe, but an Action, a sum-total of Actions and Activities?...the All of Things is an infinite conjugation of the verb To do. Shoreless Fountain-Ocean of Force, of power to do; wherein Force rolls and circles, billowing, many-streamed, harmonious; wide as Immensity, deep as Eternity; beautiful and terrible, not to be comprehended.<sup>67</sup>

This is indeed a living, not a mechanical universe, where the ground state is not that of permanent entities held steady by an equilibrating system of forces, but working energy, forces acting on one another and transforming both themselves and the incomprehensible sum of things through time. "All things are in revolution; in change from moment to moment, which becomes sensible from epoch to epoch: in this Time-World of ours there is properly nothing but revolution and mutation, and even nothing else conceivable" (vol. 1, book 6, chap. 1). A stable universe, conceived and diagramed as a conjugation of the verb to be, has been exploded into complex endlessly evolving turmoil that offers the viewer no godlike standpoint for a comprehensive overview, no spatialized map or blueprint, since "From beyond the Star-galaxies, from before the Beginning of Days, it billows and rolls,—round thee, nay thyself art of it, in this point of Space where thou now standest, in this moment which thy clock measures" (vol. 2, book 3, chap. 1).

At the level of the phenomenal, this "infinite Complex of Forces" exists as an unstable chaos, but subject to historical reflection, the chaos of the actual is qualified by an organic rule of growth and decay. It is velocity, Carlyle allows, that marks off revolution from mutation and its season from more ordinary times. But at some point rate becomes rupture. And in particular the French Revolution, fanatic against "the world of formulas" and forms, "overstepping all rules and experience; the crowning Phenomenon of our Modern Time," means rupture:

means here the open violent Rebellion, and Victory, of disimprisoned Anarchy against corrupt worn-out Authority: how Anarchy breaks prison; bursts up from the infinite Deep, and rages uncontrollable, immeasurable, enveloping a world; in phasis after phasis of fever-frenzy;—till the frenzy burning itself out, and what elements of new Order it held (since all Force holds such) developing themselves, the Uncontrollable be got, if not reimprisoned, yet harnessed, and its mad forces made to work towards their object as sane regulated ones.

(vol. 1, book 6, chap. 1)

Carlyle offers models both physical and biological in the figurative language that evokes the play of forces that constitute both nature and history. In the imagery of his representation, chaos erupts in the world of men when organic processes are overwhelmed by dynamic processes, when stagnation and the accumulation of dead forms and dead weight have for too long blocked the paths of growth and change. He contrasts the stillness of unobstructed growth—as of a forest oak—with the passive inertness that is the forerunner of catastrophic explosion (vol. 1, book 2, chap. 1). Generations will put up with the accumulation of evils and decay, from indolence and inertia and a fear of what lies

beneath the “thin Earth-rind” of habit. But “let but...your ‘thin Earth-rind’ be once broken! The fountains of the great deep boil forth; fire-fountains, enveloping, engulfing. Your ‘Earth-rind’ is shattered, swallowed up; instead of a green flowery world, there is a waste wild-weltering chaos;—which has again, with tumult and struggle, to make itself into a world” (vol. 1, book 2, chap. 3). The fragility of the stable crust that supports the forest oak in its slow growth is revealed in the eruption of these primal forces.

The model is geophysical and, more precisely, catastrophist, on the global scale of Burnet and Cuvier. The dynamic mechanism is that of an accumulating pressure, a pent-up growing force, as in the boiler of an overcharged steam engine, an overheated Leyden jar, a blocked lava flow. But unlike Burnet’s most graphic scenario, where the collapse of the earth’s integument produces not a world but a ruin for our habitation, Carlyle’s eruption of chaos is rife with creative potential, the integral obverse of its power to destroy.

Carlyle’s divided feelings toward the eruption of chaos find expression not simply in the tension between the organic and the dynamic, for even conflagration has a life: “Do not fires, fevers, sown seeds, chemical mixtures, men, events,—all embodiments of Force that work in this miraculous Complex of Forces named Universe,—go on growing, through their natural phases and developments,” reach their height, decline, and “what we call die?” (vol. 1, book 7, chap. 1). Even when the revolution is most volcanic, Carlyle’s language hints at organic processes seminally mustering. His deepest ambivalence finds expression in the dual face he gives to chaos itself. On the one hand there is a chaos within and without that is horrible to contemplate, represented in the language and imagery of the abyss. On the other hand there is the chaos of enfranchised energy, of irrepressible and uncontainable force, which has an unmatched power to effect change, to sweep away rot and stagnation and release the possibilities of new life. As a warning to the rash enthusiast of change, however, Carlyle reminds him “how all Knowledge and all Practice hang wondrous over infinite abysses of the Unknown, Impracticable; and our whole being is an infinite abyss, over-arched by Habit, as by a thin Earth-rind, laboriously built together” (vol. 1, book 2, chap. 3).<sup>68</sup>

A precarious suspension over the abyss reappears frequently in Carlyle’s account, often ironized with Miltonic borrowings, as when the municipal moderates, seeking to “consolidate” the French Revolution constitutionally, sit at work, “their pavilion spread on very Chaos” (vol. 1, book 6, chap. 4). Or when the vestiges of visible order (Law, Royalty, Authority) strive to keep their footing through the Constituent Assembly, and Carlyle comments, “Here, as in that Commixture of the Four Elements did the Anarch Old, has an august Assembly spread its pavilion; curtained by the dark infinite of discords; founded on the wavering bottomless of the Abyss; and keeps continual hubbub” (vol. 2, book 3, chap. 3).<sup>69</sup> Early in his epic history, Carlyle names the seething subcrustal threat as “that dark living chaos of Ignorance and Hunger, five-and-twenty million strong, under your feet” (vol. 1, book 2, chap. 6), that is, the people of France, who, as the mass in motion, released from all constraint, are also the epic protagonist of the narrative. Reflecting on the attempts of the Girondins to distance themselves from the anarchy of the September Massacres and to expunge that “black spot” in their domain, Carlyle writes, “fools, it is no black spot of the surface, but a well-spring of the deep! Consider rightly, it is the Apex of the everlasting

Abbyss, this black spot, looking up as water through thin ice;—say, as the region of Nether Darkness through your thin film of Gironde regulation and Respectability: trample it not, lest the film break, and then—!” What threatens is the maelstrom of the coming Terror, but Carlyle goes on to ask where, at that moment, would the Gironde and French patriotism be “had not that same great Nether Deep, of Bedlam, Fanaticism and Popular wrath and madness, risen unfathomable on the Tenth of August?...swinging on Prussian gibbets” (vol. 3, book 2, chap. 5). Though the chaotic energy rushing outward as the People’s Army that saved France is heroic and the chaotic energy churning inward in the brutal massacres and self-consuming Terror is horrific, it is the same energy, released in the same convulsion, acting in and through the same epic protagonist.

The complexities of Carlyle’s attitudes to anarchic energy include an indiscriminating, unmoralized enthusiasm for the thing itself. “We say therefore that an Insurrectionary France, loose of control from without, destitute of supreme order from within, will form one of the most tumultuous Activities ever seen on this Earth.... An immeasurable force, made up of forces manifold, heterogeneous, compatible and incompatible” (vol. 3, book 3, chap. 1). Though he sometimes speaks of its destructive side as sheerly annihilating, leaving a vacuum behind for whoever can fill it, more typically he credits it with the virtue, at a minimum, of clearing the way for the rebirth of possibility in the minds of men. Even the Terror—the “Destruction...of all that was destructible,” the sweeping away of “Hypocrises and Speciosities, Royal mantles, Cardinal plush-cloaks...Credos, Formulas, Respectabilities, fair-painted Sepulchres full of deadmen’s bones...the black, desperate battle of Men against their whole Condition and Environment”—even the Terror represents a despair that, “pushed far enough, completes the circle, so to speak; and becomes a kind of genuine productive hope again” (vol. 3, book 5, chap. 1).

“In all vital Chaos,” writes Carlyle, “there is new Order shaping itself free.” In the revolutionary mass armies, “this shrieking Confusion of a Soldiery,” he sees the germ of returning order for a France “nearly all ground down suicidally likewise into rubbish and Chaos.” Around that, he imagines (in an echo of the nebular hypothesis) the nation can “begin growing, and new-shaping her inorganic dust; very slowly, through centuries...into a new, infinitely preferable France, we can hope!” He remarks the presence in the Prussian host of Goethe, in whose head is the counterpart “of this same huge Death-Birth of the World” (vol. 3, book 1, chap. 7). In that same oxymoron, several times employed, Carlyle compresses the action and the significance of the whole revolution: “Behold the World-Phoenix, in fire-consummation and fire-creation...it is the Death-Birth of a World” (vol. 1, book 6, chap. 1).

In the confusions and conflicts of this death-birth process, “Dim Chaos, or the sea of troubles, is struggling through all its elements; writhing and chafing towards some Creation” (vol. 3, book 3, chap. 8). But chaos has many faces, and its creative potential is by no means always present in its immediacy or in Carlyle’s reflections on that immediacy, but rarely is it entirely lost sight of. As sheer force, “the volcanic lava-flood, bursting up in the manner described,” having swept away external checks, refuses all formula guidance in its flow. Rather, “the Movement will follow a course of its own” and seem to be led by whoever can give its tendencies voice and activity. “For the rest...as a thing without order, a thing

proceeding from beyond and beneath the region of order, it must work and welter, not as a Regularity but as a Chaos; destructive and self-destructive; always till something that has order arise,” and from the endless turbulence “the master-element get evolved” (vol. 3, book 3, chap. 1). Yet the frightfulest “Births of Time,” Carlyle notes, are not the noisiest. The violent clamor surrounding the “Reign of Terror” should pale before the prolonged suffering of the silent millions that preceded it, and if the mighty of this world will sit indolent “with the living Chaos of Ignorance and Hunger weltering uncared-for at their feet...then the dark Chaos, it would seem, will rise” (vol. 3, book 7, chap. 6). Anarchy, Carlyle declares, is abhorrent, and “we will hate Anarchy as Death,” but “the things worse than Anarchy shall be hated more.” Anarchy is destruction, “a burning up, say, of Shams and Insupportabilities; but which leaves Vacancy behind” (vol. 3, book 7, chap. 7). Yet he can speak of Sansculottism as the revolution reaches its conclusion as “a New-Birth of TIME; nay it still lives, and is not dead but changed. The soul of it still lives; still works far and wide” (vol. 3, book 7, chap. 6). As he has insisted earlier, there is no telling what new orders might emerge out of chaos and possibility (vol. 2, book 2, chap. 6); moreover, “Ideals do realize themselves; and grow, wondrously, from amid the incongruous ever-fluctuating chaos of the Actual: this is what World-History, if it teach anything, has to teach us” (vol. 1, book 1, chap. 2).

Carlyle calls on various strains of scientific discourse allusively, though sometimes also ironically, impatient with their systematic pretensions and intramural disputes. Thus, while he embraces the contemporary view of telluric dynamism as no mere analogy for the social realm but as continuous with it, he also brushes aside current geological bloodletting over the mechanics of change. He invokes instead a conflated “Neptuno-Plutonic Geology” combining slow attrition and explosive renovation (vol. 1, book 3, chap. 4). Throughout his revolutionary representations, a volcanic lava flood passes easily into cataclysmic deluge, with the same ambiguity in the language that one finds pictorially in some of John Martin’s contemporary scenes of natural and unnatural convulsion. The fountains of the deep boil forth as “fire fountains” to produce a primal “waste wild-weltering chaos.” The forces at work, their forms of action, are as much at home in the one element as the other and are the primary reality.

Whatever Carlyle’s feeling about Newton himself, in the play of social forces and human energies he finds almost pitiable the hopes of system and predictability on the Newtonian model, as when the Convention with its 749 members sets an agenda and a timetable for making a Constitution:

By this scientific programme shall its operations and events go on. But from the best scientific programme, in such a case, to the actual fulfilment, what a difference! Every reunion of men, is it not, as we often say, a reunion of incalculable Influences; every unit of it a microcosm of Influences;—of which how shall Science calculate or prophesy? Science, which cannot, with all its calculuses, differential, integral and of variations, calculate the Problem of Three gravitating Bodies, ought to hold her peace here.

(vol. 3, book 2, chap. 1)

The Convention proves a veritable chaos, “a fuliginous fiery mystery, where Upper has met Nether, and in such alternate glare and blackness of darkness poor bedazzled mortals know not which is Upper, which is Nether; but rage and plunge distractedly.”



But if inertial planetary systems offer no useful schema for organizing or understanding a decentered universe of myriad agents and interactions, other analogies from the physical world, current preoccupations in what was still thought of as natural or experimental philosophy, appear more apt. For example, drawing on phenomena whose conceptualization was to change the understanding of matter itself, Carlyle titles the chapter on the St. Antoine disorders of April 1789, "Grown Electric" (vol. 1, book 4, chap. 3). Of the hard winter of 1791, rife with division and incoherence, Carlyle writes, "France is as a monstrous Galvanic Mass, wherein all sorts of far stranger than chemical galvanic or electric forces and substances are at work; electrifying one another, positive and negative; filling with electricity your Leyden-jars,—Twenty-five millions in number! As the jars get full, there will, from time to time, be, on slight hint, an explosion" (vol. 2, book 3, chap. 2).

In fact, to label these "analogies from the physical world" ultimately misses the point of what Carlyle means by his "miraculous Complex of Forces, named Universe" (vol. 1, book 7, chap. 1) and how that conception informs a France on the eve of Thermidor characterized as "a world all electric," where, in the revolutionary government, "each man, enveloped in his ambient-atmosphere of revolutionary fanatic Madness, rushes on, impelled and impelling...a blind brute Force" (vol. 3, book 6, chap. 1). For wholly at one with the world of chemical, galvanic, and electrical energies is what Carlyle calls "living energy" such as he admires in Danton (through whose rough features "there looks a waste energy as of Hercules not yet furibond") and underlines in Corday ("I was a Republican before the Revolution; I never wanted energy"). His "living energy"—echoing the vis viva of kinetics—is more than the agent that makes things happen; it is the capacity to make things mean. "Man indeed," says Carlyle, writing of Louis' failure, "lives in this world to make rule out of the ruleless; by his living energy, he shall force the absurd to become less absurd. But then, if there be no living energy; living passivity only?" (vol. 2, book 1, chap. 1). It is inner force that binds action, one's own and that of others, to a course and that effectively creates the world (see Sartor Resartus). "Nay," he asks in *The French Revolution*, "what is man's whole terrestrial Life but a Symbolic Representation, and making visible, of the Celestial invisible Force that is in him?" (vol. 2, book 1, chap. 9). And if meaning lies in negation, in the destruction of a moribund order, that annihilating energy shall also find its visible expression. The guillotine makes its first appearance as "the Realized Idea," but not simply of the doctor's disembodied thought of a machine whose "huge cyclopean axe 'falls in its grooves like the ram of the Pile-engine.'" As the revolution turns upon itself, Carlyle writes: "The Guillotine, by its speed of going, will give index of the general velocity of the Republic. The clanking of its huge axe, rising and falling there, in horrid systole-diastole, is portion of the whole enormous Life-movement and pulsation of the Sanscullic System!" (vol. 3, book 4, chap. 6). Part and parody of the French Revolution's embodied energy, it is a reduction of living force to the obsessive-compulsive action of an inertial machine. It is chaos given form.

The contradiction in such a "system" finds expression in the oxymoronic slogan Carlyle adopts (in this volume called "The Guillotine") for the title of its climactic book: "Terror the Order of the Day." Its action succeeds the comprehensive image of a vortical maelstrom that reflects, throughout *The French Revolution*, not just the revolution itself but the universe of forces in which it erupts. Leading up to his description of France as a monstrous

## Galvanic Mass, Carlyle asks,

Who will paint the huge whirlpool wherein France, all shivered into wild incoherence, whirls? The jarring that went on under every French roof, in every French heart; the diseased things that were spoken, done, the sum-total whereof is the French Revolution, tongue of man cannot tell. Nor the laws of action that work unseen in the depths of that huge blind Incoherence!

(vol. 2, book 3, chap. 2)

When the “roaring fire-chaos” burst upon the Bastille in 1789, it was in a Paris where “At every street-barricade, there whirls simmering a minor whirlpool...and all minor whirlpools play distractedly into that grand Fire-Mahlstrom” (vol. 1, book 5, chap. 6). In the “September whirl” of 1792, the two cardinal movements Carlyle discerns—outward, “the stormful effluence towards the Frontiers,” and inward, culminating in the black hole of massacre and Terror—reflect the centrifugal and centripetal dynamics of the vortex form itself (vol. 3, book 1, chap. 1). Carlyle then asks the reader to consider “what side-currents and endless vortexes might depend on these” and seeks analogy in an elemental mingling that resembles nothing so much as a parched version of Turner’s storms of ocean, wind, and spume—as it were, the form of chaos: “As in dry Sahara, when the winds waken, and lift and winnow the immensity of sand! The air itself (Travellers say) is a dim sand-air; and dim looming through it, the wonderfulest uncertain colonnades of Sand-Pillars rush whirling from this side and from that, like so many mad Spinning-Dervishes, of a hundred feet in stature.” Finally, approaching the self-consuming climax in the revolution’s accelerating Saturnian involution, Carlyle writes:

We are now, therefore, got to that black precipitous Abyss; whither all things have long been tending; where, having now arrived on the giddy verge, they hurl down, in confused ruin; headlong, pellmell, down, down;—till Sanculottism have consummated itself; and in this wondrous French Revolution, as in a Doomsday, a World have been rapidly, if not born again, yet destroyed and engulfed. Terror has long been terrible: but to the actors themselves it has now become manifest that their appointed course is one of Terror; and they say, Be it so. “Que la Terreur soit à l’ordre du jour.”<sup>70</sup>

(vol. 3, book 5, chap. 1)

In reenacting the course of the revolution, Carlyle has throughout taken pains to make clear that in this pullulating universe there is a chaos that carries the possibilities of change, advance, and renewal and a chaos that opens into the unfathomable abyss. Whirlwind and vortex, the shapes of energy in motion, hold both possibilities, and significantly it is the precipitation of the mechanical from “system”—its emblem the guillotine—that signals the descent into annihilation. Nearly a decade before The French Revolution, Carlyle assayed a diagnosis of modern tendencies under the title “Signs of the Times.” There he characterizes the present as “above all others, the Mechanical Age. It is the Age of Machinery, in every outward and inward sense of that word.”<sup>71</sup> Natural science and even mathematics, he says, have become mechanical, the former focused narrowly on “the special sciences of matter.” As an example, “without undervaluing the wonderful results which a Lagrange, or Laplace educe,” he instances the latter’s *Mécanique céleste*.<sup>72</sup> He then urges that “there is a science of Dynamics in man’s fortunes and nature, as well as of Mechanics,” a science that treats of “the primary, unmodified forces and energies of man.” And he wishes to distinguish the mechanical—“finite, modified forms of the primal energies”—from the dynamical

—“instinctive, unbounded force” (191). As for the French Revolution, “Here, too, was an Idea; a Dynamic, not a Mechanic force. It was a struggle, though a blind and at last an insane one, for the infinite, divine nature of Right, of Freedom, of Country” (192). It was an idea—Carlyle would later suggest—whose catastrophic turn involved reassertion, within the dynamic, of the mechanical.<sup>73</sup>

The style of *The French Revolution*, written largely in the present tense rather than the historical past, is designed to bring the reader into the phenomenal grain of experience, to evoke the experience of chaos while at the same time giving it moral dimension through charged ironic reflection. In the end, history, world-history, is a matter not just of the phenomena, the maelstrom of forces, but what mankind makes of it. In the first of two further essays meditating the problem of writing history—preparing as it were for *The French Revolution*—Carlyle roots the difficulty in the nature of the actual:

it is an ever-living, ever-working Chaos of Being, wherein shape after shape bodies itself forth from innumerable elements. And this Chaos, boundless as the habitation and duration of man, unfathomable as the soul and destiny of man, is what the historian will depict, and scientifically gauge, we may say, by threading it with single lines a few ells in length!<sup>74</sup>

The despair of the historian is the fact that “Narrative is linear, Action is solid.” In his follow-up essay, however, Carlyle describes the process whereby “Universal History” in a sense writes itself—by epitomizing and contraction, forgetting and selection, in sharp temporal perspective, for “The transactions of the day, were they never so noisy, cannot remain local forever; the morrow comes with its new noises, claiming also to be registered; in the immeasurable conflict and concert of this chaos of existence, figure after figure sinks, as all that has emerged will one day sink.”<sup>75</sup> Written history emerges from what is remembered largely because it has consequence, has borne fruit that may be still ripening and growing; acted history, history as experienced, inheres in the incalculable interplay of innumerable impulses, thoughts, and doings, the Chaos of Being. Universal history he then likens to a magic web whose ever-growing fabric weaves itself forward “out of that ravelled immeasurable mass of threads and thrums” as well as to a “Hyperbolic-Asymptotic” space of infinite breadth narrowing behind us in infinite depth, “the true Epic Poem, and universal Divine Scripture.”<sup>76</sup>

Nothing is clearer than that Edmund Burke’s momentous early characterization of the French Revolution as a scene of chaotic disorder belongs to a different world, despite some striking affinities with Carlyle. Burke writes:

Everything seems out of nature in this strange chaos of levity and ferocity, and of all sorts of crimes jumbled together with all sorts of follies. In viewing this monstrous tragi-comic scene, the most opposite passions necessarily succeed, and sometimes mix with each other in the mind; alternate contempt and indignation; alternate laughter and tears; alternate scorn and horror.<sup>77</sup>

In these yoked extremes, this catalogue of incongruous mixtures, these bizarre compound monstrosities, Burke invokes common features in the imagination of chaos, but what is distinctive is his imagining it as a violation of aesthetic decorum: mingling the frivolous and the terrible, sporting not with follies but with crimes, violating genre distinctions

through their theatrical bastardizing. Since it is Burke, the delineator of the experience of the sublime, he puts it in terms of affective response: of a chaotic, that is, unstable alternation of contradictory feelings. The aesthetic, of course, is not here an independent realm; rather, as Burke's literary and artist friends argued, it is rooted in a distillation of nature. But in "this strange scene," the French Revolution, "Everything seems out of nature." That is, it is chaos, and chaos is "out of nature."

That Burke also argued against the rationalist, Enlightenment-derived abstractions of the French Revolution, including "a geometrical and arithmetical constitution" (202), and in favor of a cumulative, inherited complexity in politics and society has of late years distracted from other aspects of his thought.<sup>78</sup> In arguing that there was another way open to France, Burke actually evokes a suggestion of Newtonian mechanics, particularly the third law, as the basis of a stable political universe, a Newtonian concordia discors where the diversity of legislators and interests is reined in by "the weight of a real monarchy." All then can work together, like the action of gravitation upon the centrifugal tendencies in the planets' inertial motion, to secure a general liberty yet prevent the separate parts "from warping, and starting from their allotted places" (184). He admonishes his putative Parisian correspondent, "You had all that combination, and all that opposition of interests, you had that action and counteraction, which, in the natural and in the political world, from the reciprocal struggle of discordant powers, draws out the harmony of the universe" (183).

In Carlyle's universe of forces, far from being "out of nature," chaos is nature in its elemental aspect. And from action and counteraction in the ceaseless conjugation of the verb "to do" comes not a stable harmony but an unpredictable, open-ended unfolding whose meaning and direction depend on "living energy." Here, where Carlyle's suspicion of mechanical system appears to have traveled an order of magnitude beyond Burke's, he is in tune with the contemporary turn in scientific and parascientific thought, the widening turn from mechanics to energetics.<sup>79</sup>

## ENERGY'S IMAGE

In an argument for Turner's conceptual amplitude and truth to nature, Ruskin in *Modern Painters* puts in evidence one of Turner's skies (fig. 6.4), chosen, he suggests, almost at random. Ruskin describes less an image than an action, weather in medias res, using progressive verb forms to suggest motion and nouns that resist shape and fixity. His temporalized description evokes a slow-boiling vista in space and time of staggering complexity, where the viewer's eye moving over the canvas helps constitute the progressive action. It is a vista of spent and reviving motion, of "a drift of dark elongated vapour, melting beneath into dim haze," of wind and cloud mass broken into "numberless groups of billowy and tossing fragments...lifting...perishing." And beyond, "the eye goes back to a broad sea of white illuminated mist, or rather cloud melted into rain, and absorbed again before that rain has fallen, but penetrated throughout, whether it be vapour or whether it be dew, with soft sunshine, turning it as white as snow. Gradually, as it rises, the rainy fusion ceases." Ruskin continues his rendering of the immense play of vapor, light, and space evoked in



Turner's scene as the eye moves, engages, strains to see not outlines and entities but interpenetrating, interacting presences, and he ends on a note of disquiet, drifts "of a darker spirit, seeking rest and finding none." "Now," he declares, summing up, "this is Nature! It is the exhaustless living energy with which the universe is filled; and what will you set beside it of the works of other men?"<sup>80</sup>



FIGURE 6.4. J. M. W. Turner, *Babylon* (1836). Watercolor, after a sketch by Sir Robert Ker Porter.

Source: Victoria and Albert Museum, London. Image © Victoria and Albert Museum.

The energy that Ruskin sees Turner expressing is protean, transformative and transforming, at once universal and imbued with phenomenal particularity. It lies not in the phenomena depicted; it is the phenomena, as with Carlyle's "infinite conjugation of the verb To do." It is light and heat encountering dark and cold, energetic motion and dynamic difference, not just air and water, earth and sky, and all their intermediates. When a critic invoked Shelley's "surf-like chaos of stars, like a rout / Of death flames, like whirlpools of fire-flowing iron" to characterize one of Turner's earlier shipwreck scenes, he yoked the agitation of the seas and the spectacle of the heavens, fire and water, nature and art, in molten flow and vortical action.<sup>81</sup> But the verses assert only similitudes whereas the underlying thought in Turner's art is of a reality whose divisions, oppositions, and extremities are generative shaping forces within a continuum whose ultimate nature is identity. They belong to a reality antecedent to form. In his earlier practice and in his obligatory lectures to the Royal Academy as "Professor of Perspective," Turner accepted the utility of eliciting geometric form in the objects of representation (such as human anatomy) and by analogy in the structure of a painting. But in a later, freer situation, he annotated a proof for the engraver of his *Modern Italy* (exh. 1838), "I want the work quieter and not broken into forms. I take away forms and you follow me not, but keep all the forms." One result, he complained is "you get no tone or separation of one mass from the other."<sup>82</sup> Turner's treatment of form had by this time become an inexhaustible inspiration for sarcastic criticism, which found the models of his art in the "Dissolving Views" (a type of mechanical

projection where images cross fade) and in the opening verses of Genesis.<sup>83</sup> As early as 1816, Hazlitt astutely declared that Turner painted not objects but “the medium through which they were seen,” not objects but the primal elements of air, earth, and water. “The artist delights to go back to the first chaos of the world, or to that state of things, when the waters were separated from the dry land, and light from darkness.... All is without form and void. Someone said of his landscapes that they were pictures of nothing and very like.”<sup>84</sup>

Though all we see is light, which is energy, to attempt to paint the visible world as all energy, energy direct and unmediated, would have appeared to most of Turner’s contemporaries to be as mad an enterprise as painting the picture of Nothing. And indeed, Turner in his later decades was regularly declared to be mad, or cannily fraudulent, or at the very least lamed in his sight and command of the brush.<sup>85</sup> Vastly energetic phenomena—storms, volcanoes, catastrophic convulsions—were perfectly intelligible traditional subjects in Romantic painting, as representations of nature, or of divine wrath, or perhaps metaphorically of the passions, designed for effect or for a narrative of peril or apocalyptic disaster. Many of Turner’s more tumultuous scenes assimilated easily to such schema, but much of his later work did not. Energy as an abstract idea could also be successfully represented, as it not infrequently was in the later nineteenth century, allegorically: as in all those bronze personifications of Electricity and other useful servants of the Industrial Age. More ingeniously, it is harnessed in *Work*, Ford Madox Brown’s schematically illustrative painting of a Hampstead street scene where energy is expended variously by an array of human agents, from the navvy in sculptural arrest to the thinkers in earnest dialogue, an account more social in its character than scientific or metaphysical. Turner was after something more fundamental and more literal, something that spoke directly to what constitutes the visible world and that took account of our ways of knowing and experiencing it.

The challenge of Turner’s implicit program was among other things to the conventions of his craft. As both common sense and critical consensus would have it, the stretched canvas, offering a single, framed, and contained view, virtually prescribed immobility and the deployment of material means to achieve a fixed, physically inert, result. The great trick may have been to create the illusion of life, but in fact all painted life was ultimately still life. Its premise was that of a closed system, a system of balances and harmonies. As representation rather than enactment, it was obliged to stabilize change where change was the subject, that is, to gather in (where necessary) before and after, antecedent event and future possibility. Conventions, based on a sense of what could appropriately sustain contemplation, discouraged representing (for example) objects in free fall or the too glancingly ephemeral—the latter a limitation that artists like Constable and a line of watercolorists made it their business to challenge. But Turner’s ambitions took him beyond his abiding interest in the unstable and ephemeral, the chaos of impermanence and the vast disruptions of unimaginable forces. It drove him to attempt to see and unveil the underpinnings, the living energy, even in scenes where water, earth, and air virtually dissolve not in turmoil but in tranquil luminosity. The challenge was no less than to make manifest “the exhaustless living energy,” through its concretions and dissolutions, in its variousness and its ubiquity, and to convey its comprehensive priority in the scheme of

things, even over such a notion as a scheme of things.

If Turner's vision entailed unfixing the stabilizing armature of static geometric form, it found a lever in the dynamic behavior of fluids in motion. Particularly in those paintings where the forces of nature are unveiled in their naked intensity, Turner deployed a resource for transforming canvas and paint into what was plausibly energy's image: not the stable pyramid nor even the cone but what Hermann von Helmholtz would describe as "like the flame and the wave—only the form of motion which continually attracts fresh matter into its vortex and expels the old."<sup>86</sup> The importance of vortical form and vortical imagery in Turner's art, as the exemplary "form of motion," has not been overlooked, and such scholars as Jack Lindsay, Ronald Paulson, and W. J. T. Mitchell have offered illuminating insight into its workings.<sup>87</sup> All, in wrestling with that which makes Turner different, take heed of the climate of thought and feeling in the early nineteenth century, not omitting the revolutionary science and technology of the age.<sup>88</sup> Lindsay's suggestion of "a subterranean link here with the scientific quest of men like Hamilton and Faraday" can be grounded in Turner's manifold connections with, in particular, the extended circle of Michael Faraday. That extraordinary scientist, who wrapped his deep theoretical intuitions in the more modest garment of a brilliant experimentalist, made a lifelong pursuit of the unifying "correlation" between electricity, magnetism, and chemical activity and laid the basis of modern field theory. With the explosion of scientific discovery in electricity, heat theory, chemistry, and magnetism in the first industrial age and the persisting unresolved anomalies in Newton's account of light and even gravitation, the problem of forces acting at a distance had become clamorous. To cope, scientists postulated a zoo of imponderable fluids—electric (hence electric "current"), magnetic, caloric, and the long-lived "luminiferous ether." Whether as a wave or carried by particle, force—already enlarging into the broader idea of energy—required some form of matter for transmission, in which to move or inhere. Relatively late in his career, Faraday allowed himself to voice what he labeled "A Speculation," ideas that apparently had set the direction of much of his thinking as he grappled with such phenomena as electrical induction and conduction. In place of a material universe of integral atoms and intervening space, or vacuity, he proposed a universe that is in effect all energy, where atoms are neither more nor less than "centres of force." Such a model seemed to accommodate the known phenomena so well (eliminating the contradictions in an atomistic account of conduction, for example) that dispensing with the notion of a material, volumetric atom was no more than an application of Occam's razor. What remains, he points out, is "the system of power or forces" unencumbered, in place of "a little, unchangeable, impenetrable piece of matter [with] an atmosphere of force grouped around it." The experimentalist here becomes an epistemologist: "all our perception and knowledge of the atom, and even our fancy, is limited to ideas of its powers." If, then, "an atom be conceived as a centre of power, that which is ordinarily referred to under the term shape would now be referred to the disposition and relative intensity of the forces." Faraday's universe (like Turner's representations) dissolves the homology between "shape" and bounded form. Faraday sums up:

The view now stated of the constitution of matter would seem to involve necessarily the conclusion that matter fills all space, or, at least, all space to which gravitation extends (including the sun and its system); for gravitation is a property

of matter dependent on a certain force, and it is this force which constitutes the matter. In that view matter is not merely mutually penetrable, but each atom extends, so to say, throughout the whole of the solar system, yet always retaining its own centre of force.

Such a conception of the material universe harmonizes well, he adds, with mathematical investigations that refer “the phenomena of electricity, cohesion, gravitation, &c., to one force in matter; and also again with the old adage, ‘matter cannot act where it is not.’”<sup>89</sup>

Three years after “A Speculation,” in the momentous paper which became in English *On the Conservation of Energy* (1847), Hermann von Helmholtz clarified the intimations and investigations of half a century by giving generalized quantifiable form to the concept of energy, as protean and indestructible, as a fixed store in nature as a whole that could variously express itself as living force and stored potential, as not something apart from matter but as inseparable even from the experience of matter, the Janus face of that abstraction “matter.”<sup>90</sup> When later, to a general audience, he spoke of what persists in a wholly dynamic universe as “like the flame and the wave—only the form of motion,” he had in view, besides material appearances, the continuing self and integral human identity. It was his way (in a popular context) of leaving room for the soul in a natural world that only made sense as rapid or slow versions of perpetual flux and change. The lambent shapes to which the physical gave rise were “only the form of motion” because only the motion was fundamental.

Faraday’s argument on the mutual penetrability and indefinite extension of his “centres of force” leads him, in later papers, to explain magnetic lines of force—whose spectral presence he had long before made manifest in their trace among the filings—as having physical reality but existing “not by a succession of particles...but by the condition of space.”<sup>91</sup> The phrase “the condition of space” encapsulates the logic of field theory, redeems space from inertness and vacuity (it opens the way for Einstein’s solution to the anomalies of gravitation), and alters the imagination of physical reality. Subsequently, as William Thomson and later James Clerk Maxwell translated Faraday’s insights into legitimating mathematical language, the theoretical advantages of conceiving molecular (chemical) events as centers of force interacting led to the notion of vortical atoms—self-contained whirlpools of force whose “pressure” and persistence sustained the rigidity of matter in the physical world.<sup>92</sup>

Faraday’s modern biographer L. Pearce Williams traces the current of thought that shaped his sense of a dynamic nature to Immanuel Kant, by way of Coleridge and Humphrey Davy—the latter Coleridge’s friend, Faraday’s mentor, and an immensely popular scientific expositor.<sup>93</sup> Both in Kant’s *Critique of Pure Reason* (1781) and his *Metaphysical Foundations of Natural Science* (1786)—the first attempting to bring into the realm of science the mind’s conditions for knowing—Kant sets out to reconnect realms of discourse that had driven apart. And in both treatises, Kant envisages a universe of forces with an underlying oneness and interconvertibility. Matter is now no longer an independent substance, distributed through space and secondarily subject to universal forces, as in his *Theory of the Heavens* three decades earlier. Rather, he now argues, “Matter fills space, not by its pure existence, but by its special active force.”<sup>94</sup>

It would be difficult to demonstrate the direct influence of Kant on Faraday, let alone



Turner. But the imaginative shift to the dynamic, evolving cosmos that Kant envisaged, whose creative and destructive forces were both fundamental and (in effect) indistinguishably one, helped remake the conceptual climate for a science that found its liveliest challenges in the phenomena that expressed energy itself. Turner moved in circles prepared to think of the universe as a field of energies rather than an architecture of forms, a universe to be perceived in the dynamic shapes and dissolutions, the attractions and repulsions, the manifestations and transformations of fundamental forces.

If, as his art declares, Turner shared in such thinking, the fact remains that what we know of his direct engagement with science bears mostly on his profound interest in the nature and the relations of color and light—concerns professional and practical, if finally also much more than that. His stance toward science combined an appetite for inclusive explanation with a skepticism toward ungrounded theorizing, particularly where theory innocent of experience presumed to dictate practice.<sup>95</sup> Here Turner would have found congenial the experimental, phenomenalist bias—compared to French analytical, mathematical approaches—of English science in general, a tradition notably strong in the circle of Faraday. Turner and Faraday had come together, as Gage notes, in the late 1820s at the soirées of the lithographer J. C. Hulmandel, and Turner thereafter consulted Faraday frequently for information on the chemistry of pigments.<sup>96</sup> Faraday's circle also included the scientist Mary Somerville, who was among Turner's friends and whose work he knew.<sup>97</sup> Mrs. Somerville wrote two celebrated books in the 1830s aimed at a general audience, at least one of which, *The Mechanism of the Heavens* (1831), Turner owned.<sup>98</sup> The second, *On the Connexion of the Physical Sciences* (1834), Faraday vetted, and it often expresses his views. In it, Mrs. Somerville pursues the commonalities in the propagation of light, heat, sound, and fluid movement and, arguing "that light itself, as well as heat or sound, are not real beings, but mere modes of action communicated to our perceptions by the nerves," arrives at an underlying unity in the forces of nature.<sup>99</sup> Mrs. Somerville had attracted much attention through experiments on the magnetic influence of light, notably at the violet end of the spectrum, which John Herschel praised for their elegance and clarity. He did so while reviewing her *Mechanism of the Heavens* as offering a condensed view of the Newtonian philosophy "so vivid and judicious as to have all the merit of originality."<sup>100</sup>

Mrs. Somerville's experiments to connect light and magnetism—though later found wanting—clearly captured and held Turner's interest, not least because they complemented a link between light and chemical action, which in turn had some relation to color. Late in his life he frequented the Regent Street studio of the American photographer, J. J. E. Mayall (who was unaware of his visitor's identity). Mayall recalled one occasion when "he stayed with me some three hours talking about light and the curious effects on films of prepared silver. He expressed a wish to see the spectral image copied, and asked me if I had ever repeated Mrs. Somerville's experiment of magnetising a needle in the rays of the spectrum. I told him I had."<sup>101</sup> By that time (1847–1849), Turner the painter had given decades to exploring the condominium of color and light and to demonstrating the power of light over elemental matter, to energize, transform, and dissolve. Light as a mode of action manifesting itself to our perceptions, and capable of making and unmaking our world, was a

conception that Mrs. Somerville might help confirm for him, but it was in no way a fresh revelation.

The conjecture that there might be a common basis for light, heat, magnetism, electricity, and the forces at work in chemical action had been astir from early in the century. It arose from both analogy and experiment and played a role in the thinking of Sir Humphrey Davy, whom Turner—his near contemporary—also knew.<sup>102</sup> William Herschel, experimenting with the heating power of different parts of the spectrum as early as 1800, found (to his surprise) that maximum heating occurred beyond the red end of the spectrum. Johann Ritter of Jena then launched those experiments with the chemical effects of light (1803) that opened the way to photography. Exposing silver chloride to the sun's rays, he found that decomposition increased at the violet end of the spectrum, with maximum effect beyond what was visible, and that, exposed to infrared, the blackened salt reconstituted.<sup>103</sup> Davy, in the first lecture Faraday attended at the Royal Institution (1812), argued “the singular analogy” between “the Rays at the Violet end of the spectrum, Hydrogen gas, and the Negative Pole of the Voltaic Battery,” as contrasted to a similar cluster for the red end.<sup>104</sup> Similitude, or at some level identity, thus emerged from opposition, the tension of polarized forces: a fundamental premise of the Naturphilosophie that left its mark on Goethe—and on the color theory Turner would later apply—but that also managed to influence, if indirectly, even the generally empirical perspectives of British science.

Light and its action, though amenable to such conjectural probing, retained a challenging elusiveness among the “imponderables.” In painting and the academic thinking that informed it, the issue lay in the relation of color and light. But as John Gage has tellingly observed, for Turner—as even his Royal Academy lectures show—light was “an earlier and more urgent concern...than colour itself; it was, indeed, the condition of colour.” Moreover, especially in his later work, whose heightened palette dazzled and confused, Turner rejected prescriptions of color complementarity accepted by his contemporaries and instead often energized his canvases through what Michel Serres has described as a thermodynamic principle, creating tension and movement out of the difference between “warm” and “cool.”<sup>105</sup> Some contemporaries understood this practice very well. Turner's early biographer, for example, quotes the engraver and author John Burnet on Turner's *Fighting Temeraire*: “The picture, he pointed out to me, is divided into hot and cold colours—a favorite arrangement of the painter's. To the left is the pale, huge man-of-war, towed by the dark tug; and to the right is the setting sun; the warm colour is on the sunny side, the cold and shadow around and above the ship.”<sup>106</sup> As color had become a function of light in Turner's thought and practice, so in warm and cool oppositions lay the potential of motion, the flow of energy that created the forms of motion. And as light transformed matter, creating and uncreating images, so radiant energy—at its most intense in the direct action of the sun—could generate and consume, energize and dematerialize the natural world.

The correlation and convertibility of forces in a universe of forces, Faraday's premise and the heuristic principle leading to such conceptions as “electro-magnetism” and “the mechanical equivalence of heat,” finds indirect expression in Turner. It is implicit in those paintings where matter is consumed and outline and disengaged form are dissolved in light and motion, in those paintings that displace the geometry of solids with the forms of motion,

in those paintings that enlist the subject as perceiver, as the active force in the construction of meaning and difference from undifferentiated and unlimited activity. All three aspects of Turner's vision call for illustration, but it is worth noting beforehand where the unifying premise rises into explicitness. It does so, for example, in *Rain, Steam, and Speed—The Great Western Railway* (1844), where even Turner's title makes a point: he paints not iron and brass but steam and speed, invoking the cycling energy that animates the machine no less than the weather (sun and rain compounded) and, for that matter, the rabbit racing down the track.

Milton had sought to represent chaos as an imagined antiworld, Haydn as a protoworld. Turner in contrast must find imagery for the apprehension and reconception of chaos in an actual world, the world we inhabit now. It is a problem in representation, not however of abstract disorder any more than of abstract energy. It is the problem of representing what is already there to be apprehended as it can be apprehended, by the mind no less than the senses, using moral no less than scientific perspectives. It incorporates the experiencing and the reflective subject.

No doubt Turner's philosophical views changed and developed over the long course of his painterly life, as did his style. Nevertheless there are continuities in both art and thought, such as the motif that sets human designs and constructions in the path of the mindless forces of nature, often at their kinetic peak. The ironic aspect of that relation is reinforced in the verse fragments that accompanied (in the catalogues) many of his exhibited pieces, labeled as excerpts from a manuscript called *Fallacies of Hope*.<sup>107</sup> That attribution first appears in 1812 with *Snow Storm: Hannibal and His Army Crossing the Alps*, and it recurs regularly until 1850, just short of Turner's death. But reflections in a similar vein accompanied, for example, the 1810 *Fall of an Avalanche in the Grisons* (fig. 6.5): verses emphasizing the lurid light of the painting, the storm, the "thick drifting snow on snow, / Till the vast weight bursts through the rocky barrier," the fall of glaciers, "work of ages,"

Crashing through all! extinction follows,  
And the toil, the hopes of man—o'erwhelms.<sup>108</sup>



FIGURE 6.5. J. M. W. Turner, *The Fall of an Avalanche in the Grisons* (1810). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.

The painting is a construction of powerful contending diagonals crashing into a broken concave base, a dark cloud streaming down from the left, a vast white rush from the right, the scene without top or bottom and with rocks and whole treed ledges in mid-flight. It is the shape of catastrophe, of breakage and conflict on an annihilating scale, but it is not yet the form that takes shape in the universal flux. For that, to convey the sustained living energy manifest in the action of sea and storm, light and cloud, the painter turned to the spiraling, vortical patterns of the maelstrom and the nebula.

Much as Turner relished Thomson as a poet assimilating classical traditions to fresh observation and a feeling for nature, the difference in their century told in at least one point. On Newton's death in 1727, Thomson had written a celebratory "Poem Sacred to the Memory of Sir Isaac Newton," a catalogue of triumphs wherein one stanza declares:

The Heavens are all his own; from the wild Rule  
Of whirling Vortices, and circling Spheres,  
To their first great Simplicity restor'd.  
The Schools astonish'd stood; but found it vain  
To keep at odds with Demonstration strong,  
And, unawaken'd, dream beneath the Blaze  
Of Truth. At once, their pleasing Visions fled,  
With the gay Shadows of the Morning mix'd,  
When NEWTON rose, our philosophic Sun.

Newton's triumph here is over the Cartesian cosmos (the vortices) no less than the remoter Ptolemaic complexities of the "Schools." His identification with the sun extends (as in Pope's more famous couplet) to "Light itself, which every Thing displays" and which "Shone undiscover'd," Thomson says, "till his brighter Mind / Untwisted all the shining Robe of Day." But if Newtonian science had untwisted the "whirling Vortices" in addition to the optical spectrum and thereby undid the speculations and certainties of the Cartesians, Turner would reclaim them for his purposes, along with the image of the sun.

Vortical construction is incipient in early scenes of tumultuous sea and sky, e.g., in *Boats Carrying out Anchors and Cables to Dutch Men of War, in 1665* (1804). Turner's *Fifth Plague of Egypt* (1800) can be construed as the quarrel between force and geometry, with the angry looping descent of the clouds threatening the gleaming pyramid, matter at its most condensed in its most stable architectural form, along with the rectilinear blocks of the surrounding city (fig. 6.6). But vortical construction comes into its own in the 1810 decade, with Turner's *The Wreck of a Transport Ship* (c. 1810) and the great *Snow Storm: Hannibal and His Army Crossing the Alps*. In the first (fig. 6.7), the concave basin that constitutes the foreground sinks under the frame, drawing the viewer down. Like the rising sea at the far side, it threatens the small boat in the trough, which is engaged in rescuing survivors from the debris. Meanwhile, the bright, boiling center of foam and spray and the wreckage of a great sail, neither sea nor sky nor sail, draws all inward, countering the downward pull and focusing the giant curl. The sails of the cutter on one side, leaning right, and the deck of the massive transport, nearly vertical but still leaning left, help articulate the double thrust of the



vortex, centrifugal as well as centripetal. The illuminated broken stump of the transport's mast, parallel to the angle of the cutter opposite and to the direction of the spray, marks the fracture of a more rectilinear geometry.



FIGURE 6.6. J. M. W. Turner, *The Fifth Plague of Egypt* (1800). Oil paint on canvas.

Source: Indianapolis Museum of Art, gift in memory of Evan F. Lilly, 55.24.



FIGURE 6.7. J. M. W. Turner, *The Wreck of a Transport Ship* (ca. 1810). Oil paint on canvas.

Source: Museu Calouste Gulbenkian, Lisbon. Photo: Erich Lessing / Art Resource, New York.

In *Snow Storm: Hannibal and His Army Crossing the Alps* (1812; [fig. 6.8](#)), the vortex draws left, toward the unrealized light and warmth of the Italian plain, but the whole painting is a portent of disaster, from the startled brigands at their murderous work in the foreground (recalling familiar disasters-of-war imagery) and thrusting at rocks to start an avalanche to the baleful corona-ringed sun. The latter—“low, broad and wan” say the verses—appears to be burning through the edge of the upper jaw of the blackness, lighting

up the left, while the cooler blue-smudged whites and grays of the snowstorm circulate from the right. The jagged rocks, the cyclonic storm, the contending light, are interpenetrating energies in motion, indifferent to the antlike army, elephants and all, threading the lower reaches.

In a later painting (1837) that recalls the Hannibal, Turner's *Snow-storm, Avalanche and Inundation—a Scene in the Upper Part of Val d'Aouste, Piedmont* ("but which is which," said one reviewer, "for our life I cannot tell"), the hyperbolic assemblage of catastrophic forces loses all distinction in the ambit of the sweeping vortical curve that is their product (fig. 6.9). If the snowstorm had a special attraction for Turner, perhaps it was because the swirling flakes made visible and paintable the invisible energies, like Faraday's iron filings and magnetic "lines of force." But Turner takes the enabling of apprehension a step further in the most kinetic of his vortical weather paintings, *Snow Storm—Steam-Boat off a Harbour's Mouth* (1842), whose ever more specific title continues, *Making Signals in Shallow Water, and Going by the Lead. The Author Was in This Storm on the Night the Ariel left Harwich* (fig. 6.10).<sup>109</sup>



FIGURE 6.8. J. M. W. Turner, *Snow Storm: Hannibal and His Army Crossing the Alps* (1812). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.

In this reconstructed storm, the steamboat is in the eye of the vortex, whose spiraling whorls radiate outward to the edge of the canvas like a pinwheel, relative dark and light alternating, one curving darkening plume emanating from the fiery smokestack of the beleaguered ship. These radial lines streak an agitated, indeterminate substance that sweeps up to the left and (less markedly) down from the right where it meets the rising spume, a substance that is, especially in the foreground, brushed in concentric arcs across the path of sight. Behind the nearly silhouetted steamer, the storm thins and lightens around an opaque white cloud, presumably reflecting the vessel's signals. The dark shadow-streaks cast across the turmoil and varying opacities of the visual field make of the storm a concentrated assault on the manmade mechanism at its focus. Ruskin cites the painting to clinch his more general description of a prolonged storm at sea, where water is turned to smoke and mist; clouds, whirling and flying, to wave-top rags; and the surges, "in their

utmost pitch of power, velocity, vastness and madness,” are lifted and furrowed with the whirl of ascent “through all this chaos...[so] that there is indeed no distinction left between the sea and air”—and nothing left of object, horizon, landmark, “or natural evidence of position.” He concludes: “Suppose the effect of the first sunbeam sent from above to show this annihilation to itself, and you have the sea picture of the Academy, 1842, the Snowstorm, one of the very grandest statements of sea-motion, mist, and light, that has ever been put on canvas.”<sup>110</sup>



FIGURE 6.9. J. M. W. Turner, Snow-storm, Avalanche, and Inundation—a Scene in the Upper Part of Val d'Aouste, Piedmont (1837). Oil paint on canvas.

Source: The Art Institute of Chicago, Frederick T. Haskell Collection, 1947.513.



FIGURE 6.10. J. M. W. Turner, Snow Storm—Steam-Boat off a Harbour's Mouth Making Signals in Shallow Water, and Going by the Lead. The Author Was in This Storm on the Night the Ariel left Harwich (1842). Oil paint on canvas.



Except for its centrality, the steamboat is in one respect like the human presence in the *Snow-storm*, *Avalanche* and *Inundation* of 1837, where the band of tiny refugees in the lower right of the painting are a reminder of human vulnerability as well as a scaling device. With the steamer, human endeavor is again dwarfed and imperiled by the power and immensity of nature's energies. But the vessel, its fire and paddle wheel gleaming, its flag flying high, still asserts itself as another expression of will and energy, like the engine driving through the landscape in *Rain, Steam, and Speed* or the determined tugboat in *The Fighting "Temeraire," Tugged to Her Last Berth to Be Broken Up* (1838)—the tug black and ungainly, and doubtless no more permanent than the ghostly wooden sailing ship, but alive in the reflective waters with the colors and the spectacular energies of the setting sun.

If the painting reproduced literally the snowstorm as Turner experienced it (as the title claims), with the viewer seeing as he saw, then the "Author" could not have been on the vessel. Nevertheless, the vessel at the convergent center is both the only visible platform for viewing the storm and the focus of danger and concern, the imperiled being with which one must identify. Turner more than once told of being tied to the mast on the occasion (like Ulysses beset by the sirens), believing he would not survive. Yet the painting locates him (and the viewer) not with the vessel but in and of the storm.

As W. J. T. Mitchell aptly observes, Turner had an "eye-centered notion of pictorial space" built on an empirical analysis of how vision itself organizes our seeing.<sup>111</sup> The curvature in the base horizontals in Turner's *Wreck of a Transport*, his *Fall of an Avalanche*, and his *Hannibal* follow a notion Turner advanced in his lectures on perspective at the Royal Academy: "The eye must take in all objects upon a Parabolic curve for in looking into space the eye cannot but receive what is within the limit of extended sight, which must form a circle to the eye." This he connects to the popular "panoramic views" and the shape of the retina itself. One effect of applying such ideas is to give curvature to space; another is to give a subjective character to the rendering and reading of the scene.<sup>112</sup>

Mitchell understands the *Snow Storm—Steamboat* "both as a moment of chaos in nature and as the triumph of consciousness over chaos" (141). He argues that, in the spirit of Turner-Ulysses bound to the mast to experience the storm firsthand, the painting is "an attempt to explore the boundary between form and chaos." Noting Ruskin's complaint of too much form, he proposes that Turner is here "conscious of another decorum, the linear and geometrical structure of the vortex." He argues that the painting is as much about this form as about the snowstorm in the English Channel (139).

Yet such a resolution of the tension between nature and consciousness, such a division between formal and representational ends, would fall short of Turner's actual achievement. That is, it would get no further than Diepenbeek's Ovidian design of the elements and constellations at war. As "another decorum," form depletes, denies, or contains chaos, even when it is the form of motion. But there is no such denial if the painting is finally not about the form (the geometrical structure of the vortex) or about the snowstorm in the Channel but is rather about seeing the snowstorm in the Channel, as the title tries to tell us. What does the chaotic turmoil of the snowstorm look like from a ship (or even an



automobile) driving through it? Indeed, what is the look of nature in chaos, nature as chaos?

A passage of domesticated science with which George Eliot illuminates Middlemarch offers an analogy.

Your pier-glass or extensive surface of polished steel made to be rubbed by a housemaid, will be minutely and multitudinously scratched in all directions; but place against it a lighted candle as a centre of illumination, and lo! the scratches will seem to arrange themselves in a fine series of concentric circles around that little sun. It is demonstrable that the scratches are going everywhere impartially, and it is only your candle which produces the flattering illusion of a concentric arrangement, its light falling with an exclusive optical selection.

(chap. 27)

Eliot wishes us to understand how each subject, each ego constitutes a world, and how moral awareness is founded in an awareness of the cognitive condition. In Turner's representational model, the snowstorm elicits the invisible forces in action, but the shape of that action is inseparable from the action of seeing. The image is true to perception, but the perceived phenomena necessarily include the perceiving subject. In that sense as well, the storm and the subject are one.

Mitchell is too astute to ignore Turner's concern with perception and suggests that the spiraling lines can be read as "the visual effects of vertigo in the viewer, the so-called 'spiral after effect,'" and as a representation of "perceptual resistance to disorientation" (the effort to stabilize the visual field) (140). I question whether these additional effects are necessary to explain the experience Turner wishes to convey. However, in generalizing elsewhere on the array of vortex images to be found in Blake's pictures, Mitchell provides a wonderfully apt account of their manifold recurrence in Turner's art:

If we look for the common denominator in all these instances of the vorticular pattern we would find, I suppose, that they are all manifestations of energy.... The vortex is not exactly a "symbol" of this energy. It is the form or identity energy reveals when it encounters consciousness, a phenomenological pattern or structure that is partly perceptual Gestalt, partly "real, objective form," partly pure geometrical idea.

(158–159)

It is above all "the form or identity energy reveals when it encounters consciousness" that Turner puts before us on his canvas.

If the uncontainable play of living energy is to escape containment in the mere fixity of an image, however, its encounter with consciousness will seek a counterpart both in representation and in the experience of the actual viewer. Numerous contemporary accounts call attention to Turner's way with a painting on varnishing day and to how paintings in his later period did or did not seem to assemble themselves out of what, on near inspection, were unintelligible strokes and blobs. These testify to the bravura—extraordinary in contemporary academic practice—whereby Turner seeks to bring into play the processes of perception and cognition in his art. But the painting that seeks to incorporate the perceiving subject most vividly and unusually in its subject is the much argued-over *Regulus* (1828; reworked 1837; [fig. 6.11](#)). It is not just the act of viewing that is brought forward here into the glare but also the action of light in the making and unmaking of the actual world.

Most of the debate concerns the presence of *Regulus* in the painting. The painting is

constructed as a vortex with a blinding center and a broad path of light leading from that center over the surface of the agitated water to the foot of the somewhat elevated viewpoint we occupy but do not share with any evident pictorial surrogate. The optical circle or cone from that viewpoint finds emphasis in the concave curvature of the foreshore, the subtle lateral arc of the breakers, the parabolic curve into the depth of the horizon, the umbrella curvature of the striated clouds, set off by the blue sky in the corners. The harbor wings—shipping and some functional structures at left, palatial buildings and platforms at right in receding perspective—further constrain the optical path and, as it were, compel it.

It was only as recently as 1969 that a commentator—John Gage—had the wit to put Regulus at the near end of the path of light, in the position of the viewer, which also puts the viewer in the place of Regulus.<sup>113</sup> A Roman general held captive by the Carthaginians, Regulus was dispatched to negotiate an agreement with Rome. As Turner knew the story, the Roman denied himself admittance at the gate, deliberately sabotaged his mission to the Senate, and then returned to Carthage to face the consequences, where he was punished by having his eyelids cut off and being made to gaze at the sun. The moment of the painting is not clear from the original title—unusual in Turner’s historical painting and here, I believe, deliberate. A subsequent engraving, however, identifies the scene as Ancient Carthage—the Embarkation of Regulus, and a case has been made for regarding a figure deep in the painting as Regulus, a reading that would bring an interesting temporal complexity to the narrative strategy. The blinding of Regulus by the sun would then have to be understood as implicit in the moment of embarkation, just as the subsequent fate of Carthage is already implicit in what we see. For if the action of light is necessary to the creation of the scene, its energies are also engaged in its unmaking—both the blinding of the virtual perceiver and the proleptic dissolution of the materially invested Carthaginian world. The radiant vortex of light in the painting consumes as it expands: sky and sea, port and palace, whatever is drawn into the path of the sun’s reflection.<sup>114</sup>



FIGURE 6.11. J. M. W. Turner, *Regulus* (1828, reworked 1837). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.

The painter's own engagement with the action of light, the kinesis of perception, and historical instability is captured in the young John Gilbert's account of Turner at work on *Regulus* after it was hung, conflating image and process. He speaks of Turner's "scumbling a lot of white into his picture—nearly all over it," driving white into every part of the surface. "The picture gradually became wonderfully effective, just the effect of brilliant sunshine absorbing everything, and throwing a misty haze over every object."<sup>115</sup> The effect, however, was not wholly benign. One responsive if ambivalent reviewer complained, "here all is glare, turbulence, and uneasiness."<sup>116</sup>

Where painting aspires to a point of view on the natural world or the human experience, the physical issues can have metaphysical bearings and the cognitive process a moral dimension. Especially at the point of intersection between the universe of unassimilated forces and human intention and awareness does the issue of chaos arise, not simply with respect to the forces themselves or the perceiving consciousness but in the relation of the two. What Turner depicts is not only the character of light and motion or the play of forces in an indifferent universe but their mental construction into intelligible experience. The subject's role in Romantic psychology in constituting a reality is written in Turner's paintings as invitations to seeing. But it is at that point that the moral and metaphysical issues arise.

Turner is conscious of a deep irony in the disjunction between the work of the subject in constituting the visible and the coherent and the absence of a metaphysical sanction or a decent theodicy. His *Fallacies of Hope* are an attempt to express that irony, if not systematically, then fragmentarily. As poetry, it only occasionally succeeds, but as philosophy, it stands in contrast to a poem of similar title and traditional point, Samuel Johnson's admirable *Vanity of Human Wishes*, where the vanity is relative to a putatively more worthwhile, more authentic reality elsewhere. Turner, however, to his credit, confines his pursuit of reality to this world.

Among the most naked and condensed expressions in Turner's art of the chaotic where energy and consciousness meet is the nightmarish *Slavers Throwing Overboard the Dead and Dying—Typhoon [sic] Coming On* (1840; [fig. 6.12](#)). It is a painting whose logic is in the fragmentation of coherence: the jumble in the agitated soup that fills the lower half—all fragments, limbs, fish, birds, monsters, chains; the dark-red muddy reflections of the angry storm sweeping in from the left, indistinguishable from blood in the water; the blaze of the setting sun right down the middle, clearing a path and giving a redness to the storm that is already churning the sea around the distant ship into spume and obliterating the distinction between sea and sky. If the typhoon invites the thought of an apportioned cosmic vengeance, the typhoon itself is the precipitating cause of the human acts that here compound the original atrocity. There is no classical dike and no cool relief anywhere in the scene—just degrees of heat in a divided field. It is a scene of horror, full of cruel energy that resists the constructive consciousness.



FIGURE 6.12. J. M. W. Turner, *Slavers Throwing Overboard the Dead and Dying, Typhon Coming On* (1840). Oil paint on canvas.

Source: Museum of Fine Arts, Boston, Henry Lillie Pierce Fund, 99.22. Photo © 2014 Museum of Fine Arts, Boston.

The irony in the undoing of human hopes and intentions that is the theme of Turner’s fragmentary poem is grimly acidified in the case of the *Slavers* rubric, by being framed in terms of their hopes of a good market.<sup>117</sup> The callous myopia in this case serves its contrastive purpose, but often the *Fallacies’* commentaries and their moralizing ironies seem (and seemed to contemporaries) irrelevant or inadequate to the content of Turner’s paintings or to the measure of their ambition: as enactments of the uninflected energy that is the alpha and omega of everything, the groundwork and the overwhelming emergent reality. It overwhelms, that is, the formal, containing, limiting constructions—Carthage, Rome, the individual subject, the conventions that cut off sea from air, color from light, and the experiencing consciousness from the authentic, unprocessed universe. Light seems to be as close as the senses can bring us to that uninflected energy, and so the sun not as an object but as the utmost intensity of light becomes the unorthodox focus of some of Turner’s most forceful, visually overwhelming paintings and some of the most tranquilly ecstatic.

The obverse of the image that shows a universe of forces acting with no regard for human concerns is one that dissolves the boundaries between self and universe, as contained form and outline give place to fields of tone and color. The elevated pastoral strain and the paradisiac scene—as emergent creation—were strong in Turner’s art from the beginning. The latter is nowhere more tranquilly ecstatic than in the late *Norham Castle, Sunrise* (fig. 6.13; ca. 1840–1850), though the theme of “sun rising through vapor” runs all through Turner’s working half-century. *Norham Castle*, however, is one of nearly a dozen paintings from his final decade grouped in the authoritative catalogue as “Unfinished Paintings, mainly of *Liber Studiorum* Subjects” (subjects etched or engraved and published starting in 1807), which the authors characterize as seeming to be “in the state in which Turner took such unfinished works into the Royal Academy or the British Institution before completing them on varnishing days.”<sup>118</sup>



What these canvases and others classed as “Late Unfinished Sea Pieces” disclose is something more than a technical practice, a stage in the picture-making process. For what functions as the foundation of the painting is also a conception of the ground state of what is being depicted, the ground state of the natural world. It was about this time (in 1845) that Faraday introduced the term field “to capture the sense of a space filled with forces in which objects moved between places of differential strength.”<sup>119</sup> According to one historian of science, “With the establishment of the concept of the field, we might see the end of the Age of Newton and the beginning of the Age of Space, regarded not as void but as configured terrain admitting curvature of mass and density.”<sup>120</sup> What we have in *Norham Castle, Sunrise*, one of the most developed of Turner’s supposed threshold paintings, is a complex modulated field, radiant at the center, where the emergent accents (the elevated ruin, the cattle) are extended and absorbed in the lingering mist and on the luminous wet surfaces. Elsewhere, as in *Seascape with Distant Coast* (cat. 467), *Seascape with Buoy* (cat. 468), and *Sun Setting Over a Lake* (cat. 469), the accents are without local contrast as yet. In the last, a differentiated field appears to be generated by two foci whose intersecting gradients of light and color (warm to cool) produce the characteristic diagonal polarization in so many of Turner’s oblong canvases. Such tension along a diagonal generated between intersecting vertical and horizontal polarities of color and light vitalizes the better-known *Sunrise with Sea Monsters* (cat. 473), where the monsters, like the hoary gray whale in one of the finished and exhibited paintings called *Whalers* (1845), are barely emergent. In the latter painting (fig. 6.14), the whaling ship with its white sails (partly outlined) and whitish hull against the gray-white spume and mist is somewhat more distinct, and the men in the foremost boats rowing and hurling lances and casting hot and dark reflections still more so, offering a gradient of accents within the tumultuous polarized field of sea and sky. It is noteworthy that Turner’s whaling series, known to Melville if only through descriptive criticism, is likely to have inspired the painting at the Spouter Inn, launching Melville’s epic of the hubristic endeavor to bring the chaotic forces of the universe under the mind’s dominion.<sup>121</sup>



FIGURE 6.13. J. M. W. Turner, *Norham Castle, Sunrise* (ca. 1840–1850). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.

The circulation, dissolution, and transformation of matter by and into forms of energy can become all-consuming, as in the universalizing Deluge paintings (1843) and Turner's *Angel Standing in the Sun* (1846), where vortical structure affects even the shape of the canvases. Yet all of these, even *Shade and Darkness—The Evening of the Deluge*, circulate around an energizing, disembodying center of light. The powerful vortex of *Light and Color* (Goethe's Theory)—*The Morning After the Deluge* (fig. 6.15) is both whirlwind and matrix, a vision of consummation, but with Moses writing Genesis, barely seen in the luminous center, along with a looped serpent (the Brazen Serpent, Numbers 21:6–9), its coils forming a symbol of infinity to add to its ambivalent attributes. The accompanying verses from *Fallacies of Hope* both announce a new foundation and undercut it as illusory:

The ark stood firm on Ararat; th' returning sun  
Exhaled earth's humid bubbles, and emulous of light,  
Reflected her lost forms, each in prismatic guise  
Hope's harbinger, ephemeral as the summer fly  
Which rises, flits, expands, and dies.



FIGURE 6.14. J. M. W. Turner, *Whalers* (1845). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.



FIGURE 6.15. J. M. W. Turner, *Light and Color (Goethe's Theory)*, *The Morning After the Deluge, Moses Writing the Book of Genesis* (1843). Oil paint on canvas.

Source: Tate Britain, London. Image © 2014 Tate, London.

Jack Lindsay, noting the congruence with the shape of the iris-edged image as a whole, argues ingeniously that “Each bubble, each individual life, by enclosing the prism of colour, encloses the whole of light, and is a microcosm. The vortex has become the seething womb of life.” In my reading, the final lines, which deliver the punch, leave little room for so positive a conclusion or for the rainbow prospects of any new forms. There is no avoiding the message of delusive ephemerality, reinforced in the apparent fossil remains of the flood in the foreground. But from another perspective, prismatic reflection in Turner’s thought does imply, besides a dialogue with form, a kind of immortality, like the background radiation currently identified as the cosmic echo of the early universe. Lawrence Gowing, in the catalogue essay for a landmark exhibition designed to explore Turner’s “modernity,” called attention to his obsessive, repetitive preoccupation with reflections (“Reflexies”), notably in his Royal Academy lectures after exposure to the light and art of Italy. Turner’s argument in the lecture, Gowing says,

is a reverie on the indefinite transmission and dispersal of light by an infinite series of reflections from an endless variety of surfaces and materials, each contributing its own colour that mingles with every other, penetrating ultimately to every recess, reflected everywhere, “plane to plane, so that darkness or total shade cannot take place while any angle of light reflected or refracted can reach an opposite plane.” Turner’s axiom, in fact, amounted to a whole view of the world.... “We must consider every part as receiving and emitting rays to every surrounding surface...” It was not only a view of nature. The idea of the infinite interpenetration of natural radiance was necessarily also an idea of painting.<sup>122</sup>

Here, Gowing argues, we are already in the world of the late nineteenth century with respect to art, but here we are also in the world as imagined by Faraday, where every

point is a center of force extending and interpenetrating through the whole of things and where physical forces not only correlate but constitute a continuous web of interactivity, modulating and translating themselves and one another. In science, one line of development, through Helmholtz, Maxwell, and others, with Kantian infusions, led to the “energetics” of the late nineteenth century associated with Wilhelm Ostwald. And that in turn reemerged in interpretations of quantum reality that no longer dissociate what exists from how you look at it, that dematerialize matter, and allow for chaotic spontaneity. Werner Heisenberg finds an ancestor for such foundations in Heraclitus and that philosopher’s solution to the antithesis of Being and Becoming, namely, “that change itself is the fundamental principle.... But the change in itself is not a material cause and therefore is represented in the philosophy of Heraclitus by the fire as the basic element, which is both matter and a moving force.” This, Heisenberg says, brings the Greek philosopher into the world of modern physics, for “If we replace the word ‘fire’ by the word ‘energy’ we can almost repeat his statements word for word from our modern point of view. Energy is in fact the substance from which all elementary particles, all atoms and therefore all things are made, and energy is that which moves.”<sup>123</sup>

## POSTLUDE: ENERGY’S ACOLYTES

The valorization of energy unbound, energy at once destructive and creative, had a fateful afterlife in the art and politics of the twentieth century. One notable vector was the current of thought that led from Kant (and Rousseau) through Schelling and the Romantics, Schopenhauer, Nietzsche, to the perverse energetics of the Third Reich. Another was the transformed sensibility that replaced the clock—a mechanism that in its ideal form could model homeostatic perpetual motion—with the steam engine, the prime instrument for change in the new industrial age. As the technology that made the running in the developing nineteenth century, the steam engine performed work, measured in horses or foot-pounds or miles traversed per hour, altering reality—time, space, and the visible scene—rather than perpetuating it, all the while consuming and combusting matter. With the need for a common calculus for measuring efficiency and the transformations of substance into heat and force, the abstract idea of “energy” came into its own: energy defined as the capacity to do work, which is to effect change. It was then only another short step (via the cautiously named “correlation of forces”) to a simplifying reciprocity: from energy as a transforming agent to energy as what is and is transformed. In the course of the century, nature as such becomes, in the phrase of John Theodore Merz, “the playground of the transformation of energy.”<sup>124</sup>

The machine, translated from its original industrial-age character into the dynamo, the internal combustion engine, and the automaton or artificial life, took center stage in the next century in a number of modernist programs, but never more aggressively than in the programmatic art of the Italian Futurists, where it is celebrated as the embodiment of revolutionary energy and unqualified force.<sup>125</sup> Nevertheless, only two years before the first “Manifesto of Futurism” by the antihistorical Marinetti (1909), it had already achieved an



apotheosis as the totemic god of the modern world in the reflections of the historian Henry Adams, child of the nineteenth century, in the figure of the dynamo. The Futurist machine is expressed as motion; Adams's imagery of the dynamo remains iconic, power as presence in its near-silent working. But both are offered as expressive representations of primary force, or energy. As the reluctant prophet who would soon link modernity, in its full economic, political, and technological expression, with the physical fate of the universe by invoking the law of entropy, energy's dark complement, it was only fitting that Adams first be the uneasy acolyte of energy, its logical and historical predecessor. In the early twentieth-century world, that meant recognizing the prodigious energies not simply of the mass of men in their seething multitudes but of their creature-become-partner the machine.<sup>126</sup>

The true competitor with mechanism in the nineteenth century was the triad of vitality as a phenomenon, organicism as an ideology, and evolutionary biology as a science, from which flowed alternative models for understanding process and change. The rivalry, however, was never complete. The Naturphilosophie that affected much scientific thought early in the century was a conscious attempt to bridge organic and inorganic realms. "Vital force" often made its way into the lists of "imponderables" to be reconciled with a physical mechanics. Helmholtz ends his momentous treatise "On the Conservation of Energy" by including the energy economy of living organisms. And even Bergson, who grounded much of his thought on the radical difference between the mechanical and the vital, finds room for a hybrid, at least by way of analogy. When in a chapter of *Creative Evolution* called "Form and Becoming" he argues that life is an evolution and its forms only "the fortunate inertia of our perception," he explains that phenomenon by a mechanical-perceptual analogy. "But in reality the body is changing form at every moment," he continues, "or rather, there is no form, since form is immobile and the reality is movement. What is real is the continual change of form; form is only a snapshot view of a transition." And then, to explain how we cope with this universal becoming in our living minds, Bergson declares, with emphasis, "the mechanism of our ordinary knowledge is of a cinematographical kind."

Not that he finds such ordinary knowledge sufficient, however useful in our interactions. "Instead of attaching ourselves to the inner becoming of things, we place ourselves outside them in order to recompose their becoming artificially." Meanwhile, reality, or true movement, "slips through the interval, because every attempt to reconstitute change out of states implies the absurd proposition, that movement is made of immobilities."<sup>127</sup> Nevertheless, in this overlay of mind and mechanism, of frame-registering camera and motion-reconstituting viewer, Bergson is already in the realm of Dziga Vertov's constructivist masterpiece *The Man with a Movie Camera* (1929) while Adams is perhaps still a step or two in the rear of Chaplin's *Modern Times*. And as it happens, much of the most interesting early Futurist painting—still confined by the temporally inert canvas in a frame—is the conscious effort to transfigure the quantum proposition "that movement is made of immobilities."

The art and imagination of the twentieth century, with its compulsion to transgress the limits, reverberates between the anarchists on one side and the minimalists on the other, between the chaos of energy and that of entropy. On the field of action—language, paint,

or installation—the distinction between the one chaos and the other is not always clear. But on the whole, those successive segments of the twentieth-century avant-garde engaged in the programmatic demolition of forms, institutions, fixed practices and assumptions while celebrating their own vitality and originality carry forward a program of positive chaos that belongs in the camp of energy. The Futurists claim particular notice here if only for their explicitness, both in declaration and illustration, though as usual their art, when it succeeds in representing the chaos, does so by an indirection rife with structure and pattern. Their first manifesto, F. T. Marinetti's, argued for a poetry that embraced "the habit of energy": speed, as of the racing car; "war—the world's only hygiene"; "great crowds exalted by work, by pleasure, and by riot...the multicoloured, polyphonic tides of revolution in the modern capitals"; an industrial landscape in motion, alive and mythologized:

We will sing of the vibrant nightly fervour of arsenals and shipyards blazing with violent electric moons; greedy railway stations that devour smoke-plumed serpents; factories hung on clouds by the crooked lines of their smoke; bridges that stride the rivers like giant gymnasts, flashing in the sun with a glitter of knives; adventurous steamers that sniff the horizon; deep-chested locomotives whose wheels paw the tracks like the hooves of enormous steel horses bridled by tubing; and the sleek flight of planes whose propellers chatter in the wind like banners and seem to cheer like an enthusiastic crowd.

Marinetti's epic animations, romanticizing the technology of motion and the industrial scene, bring out the relative sobriety and literary modernity of a comparable extravagant passage in Adams's autobiographical memoir, where, sailing into New York harbor in 1904 after many years away, he sees a spectacle of anarchic energy enfranchised, where everything from the crowds to the politics "shrieked chaos":

The outline of the city became frantic in its effort to explain something that defied meaning. Power seemed to have outgrown its servitude and to have asserted its freedom. The cylinder had exploded, and thrown great masses of stone and steam against the sky. The city had the air and movement of hysteria, and the citizens were crying, in every accent of anger and alarm, that the new forces must at any cost be brought under control. Prosperity never before imagined, power never yet wielded by man, speed never reached by anything but a meteor, had made the world irritable, nervous, querulous, unreasonable and afraid.

(Education, 1176)

Anticipating the expressive imagery of the Futurists and their successors, Adams's is as vivid a vision of the modern age as anything in Marinetti's manifestos, qualified by the inferential note of panic among the solid citizenry and the shrinking conclusion.

In Marinetti's first manifesto, the call was for a poetry conceived as "a violent attack upon unknown forces," in a program that "will destroy the museums, libraries, academies, moralism, feminism," for an art that "in fact can be nothing but violence, cruelty, and injustice."<sup>128</sup> The next year, in a spate of complementary manifestos, the painters Umberto Boccioni, Carlo Carrà, Luigi Russolo, Giacomo Balla, and Gino Severini declared themselves "no longer satisfied with Form and Colour" as hitherto understood. "The gesture which we would reproduce on canvas shall no longer be a fixed moment in universal dynamism. It shall simply be the dynamic sensation itself"—including the multiplication of moving objects as if in a flicker book and their vibratory changes of shape.<sup>129</sup> For the benefit of the visitors to a Paris and London exhibition of their work in 1912, they explained their designs on the spectator: to place him "in the centre of the picture."

If we paint the phases of a riot, the crowd bustling with uplifted fists and the noisy onslaughts of the cavalry are translated upon the canvas in sheaves of lines corresponding with all the conflicting forces, following the general law of violence of the picture.

These force-lines must encircle and involve the spectator so that he will in a manner be forced to struggle himself with the persons in the picture....

It is these force-lines that we must draw in order to lead back the work of art to true painting. <sup>130</sup>

The involvement of the perceiving consciousness in the phenomenal storm is the visual argument in Umberto Boccioni's series, *States of Mind* (1911), and his was the leading voice in this last manifesto. Soon after, he emitted a "Technical Manifesto on Futurist Sculpture," where he urged, with anarchic relish, "Let's turn everything upside down and proclaim the ABSOLUTE AND COMPLETE ABOLITION OF FINITE LINES AND THE CONTAINED STATUE. LET'S SPLIT OPEN OUR FIGURES AND PLACE THE ENVIRONMENT INSIDE THEM."<sup>131</sup> Boccioni, painter and sculptor, perpetrated one of the more arresting images from the movement as a kind of negative manifesto and called it *Materia* (1912). Based on a portrait of his mother (the title is a Latinate pun), matter is here allegorized as an old peasant woman, emerging from and receding into the fractured planes and lines of force that warp the powerful symmetry (fig. 6.16). At dead center, fully realized, are her extraordinary hands, thrusting forward, battered and swollen, locked over her belly above the receding trapezoid of her skirt, which is framed in fragment and debris and appears as a curtain over darkness. Antithetically implicative of an "Energia," while projecting enduring material resistance, the figure carries a whiff of embodied chaos from an earlier tradition that is deeply negative.<sup>132</sup> The picture evokes both vortex and abyss, a pull into nothing that contrasts with, say, Balla's *Vortice* of 1913, a complex of expanding and converging curves and lines that explodes off the paper.

Other picture titles draw on the language of physical science, similarly creating tension between their abstract simplicity and the complexity of the images that attempt to render them, as in Boccioni's *The Forces of a Street* (1911), his *Elasticity* (1912), or "Work" (*Il lavoro*), the original title of *The City Rises* (1910–1911). The last was one of five huge paintings from the Futurist group, all heavy with the theme of civil anarchy, sent to the Milan exhibition of 1911. Carrà's *Funeral of the Anarchist*, Galli shows the encounter of mounted police with the crowd as a clash of diagonals and arcs, including an expanding series that would seem to represent sound (fig. 6.17). Boccioni's *The City Rises* has it erupting in a vibrant hybrid of dray horses like flames, their shoulders seemingly collared with sinister inverted whirlwinds and men straining to augment as well as contain their energy and aggression (fig. 6.18). In the dissolution of forms and the title's ambiguity, the New comes to be. In Luigi Russolo's *La rivolta* (fig. 6.19), a red wedge forged out of angular iterated human figures thrusts in from the right, preceded by a set of jointed diagonals, also red, like an angular shock wave, expanding progressively across the canvas and overlaying the rectilinear, diagonally set cityscape, creating new reticulations. Similarly, Giacomo Balla's *Abstract Velocity* was built upon a series of arcs expanding from right to left, multiplying and reiterating through change and generating linear and angular traces, but it carried no overt suggestion of social conflict except in so far as dynamism itself, thrust and motion, carries a disruptive charge. Balla elaborated a series of *Velocità d'automobile* paintings and drawings, analytic representations of force and motion, highly abstract, translating form

(and in ambition, light and sound) into line and curve. But perhaps his most singular achievement is in the conceptual rigor and complex beauty of his *Wavering Lines + Dynamic Sequences: Flight of Swallows* (1913; [fig. 6.20](#)), whose tensions, patterns, and arabesques, as an abstraction of the dynamic workings of unconstrained nature, anticipate the marriage of randomness and iteration in the latter-day descriptive science also called “Chaos.” Such imagery, given standing as “the geometry of nature,” is only the latest term in the long dialogue between the indwelling human necessity to constrain energy, uncontained and unpredictable, in structure and system, and the countervailing impulse to liberate possibility in randomness and change.



FIGURE 6.16. Umberto Boccioni, *Materia* (1912–1913). Oil paint on canvas.

Source: Gianni Mattioli Collection, on long-term loan to the Peggy Guggenheim Collection, Venice. GM4.





FIGURE 6.17. Carlo Carrà, Funeral of the Anarchist, Galli (1910–1911). Oil paint on canvas.

Source: Museum of Modern Art, New York, acquired through the Lillie B. Bliss Bequest. Digital Image © The Museum of Modern Art / Licensed by Scala / Art Resource, NY. © 2014 Artists Rights Society (ARS), New York / SIAE, Rome.



FIGURE 6.18. Umberto Boccioni, The City Rises (1910–1911). Oil paint on canvas.

Source: Museum of Modern Art, Mrs. Simon Guggenheim Fund. Digital Image © The Museum of Modern Art / Licensed by Scala / Art Resource, NY.



FIGURE 6.19. Luigi Russolo, *La rivolta* (1911). Oil paint on canvas.

Source: Gemeentemuseum Den Haag, Netherlands. Photo: M. E. Smith, © DeA Picture Library/Art Resource, NY.

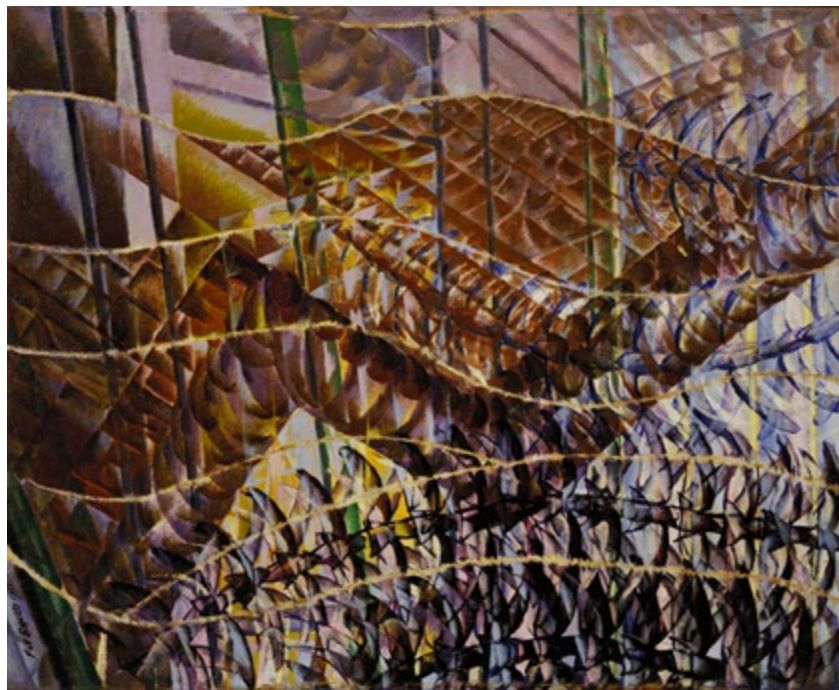


FIGURE 6.20. Giacomo Balla, *Wavering Lines + Dynamic Sequences: Flight of Swallows* (1913). Oil paint on canvas.

Source: Digital Image © The Museum of Modern Art / Licensed by Scala / Art Resource, NY.

# ENTROPY

## TIME AND TIDE

O ruined piece of Nature! This great world  
Shall so wear out to naught.

—King Lear (4.136–137)

The politics of energy were destabilizing, and the metaphysics not much less so. In valorizing disruptive turmoil, ceaseless nonrecurrent motion, protean shape changing that unsettled identity and in some respects materiality itself, energy unbound and unbounded upset the sense of having arrived at a reliable framework for understanding the world. Arguments on the stability of species, the nature of geological processes, and the age and immensity of the world brought similar unsettling challenges. Such cognitive distress provokes not just rejection but ingenuity, and in the matter of energy it did so by reinvigorating an earlier stabilizing formation, the notion of a law of “conservation.”

## CONSERVATION AND CONVERTIBILITY

Historically, a conservation principle in the physical realm found a variety of applications and expressions. Among the original atomists, it was matter in its irreducible, indestructible form that was conserved. Still axiomatic for Newton,<sup>1</sup> the conservation of matter extended, as in the new chemistry, into the conservation of mass. Descartes had advanced a conservation of motion in his adumbration of inertia. The conservation of vis viva, or “living force” in the language of Leibniz, and of momentum, or the product of mass and velocity, served in the science of mechanics, and Helmholtz’s unifying generalization, embracing the phenomena of mechanical action, heat transfer, electrical processes, and magnetics, initially used the term force (Kraft) for what was unfailingly conserved—and convertible. It was “force” rather than “living force” because it included “tensional” as well as kinetic values. As such, it could be reckoned as quantitatively constant through change of state, place, and form. With his *Über die Erhaltung der Kraft* (1847), Helmholtz had arrived at the foundational principle or “law” whereby “Force” could modulate into something more classically inclusive, as “The Conservation of Energy.”

Nor was Helmholtz altogether alone in this breakthrough. In a famous paper on the subject, Thomas Kuhn pronounces, “The history of science offers no more striking instance of the phenomenon known as simultaneous discovery.”<sup>2</sup> Kuhn finds a dozen men who advanced essential parts of the idea of the conservation of energy between 1832 and 1854.



For example, two months before Helmholtz read his paper, the Manchester scientist James Joule independently advanced a similar conclusion in a talk distilled from earlier experimental work. With admirable lucidity, Joule argued that “heat, living force, and attraction through space...are mutually convertible into one another. In these conversions nothing is ever lost.” And he shows how their equivalency can be expressed quantitatively, “in definite language applicable at all times and under all circumstances.” Consequently, while the phenomena of nature, “whether mechanical, chemical, or vital,” exist in a continual flux of forces converting into one another,

order is maintained in the universe—nothing is deranged, nothing ever lost, but the entire machinery, complicated as it is, works smoothly and harmoniously. And though, as in the awful vision of Ezekiel, “wheel may be in the middle of wheel,” and every thing may appear complicated and involved in the apparent confusion and intricacy of an almost endless variety of causes, effects, conversions, and arrangements, yet is the most perfect regularity preserved—the whole being governed by the sovereign will of God.<sup>3</sup>

Chaos, or universal arbitrariness, is held at bay, despite the general flux, when, as another of these conservationists put it, the energies are “quantitatively indestructible and qualitatively convertible entities.”<sup>4</sup>

Kuhn sets out to elicit, in the climate of science as it developed from the beginning of the century, what he calls “trigger factors” for so widely shared a discovery. It is perhaps not too bizarre to add to them the pressures and even the language of the politics of the age. The French historian and conservative statesman François Guizot, in his admiring *Memoirs of Sir Robert Peel*, speaks of the whole of politics since 1789 as a confused contention between “the spirit of order and the spirit of liberty,” between distrust of human weakness and sympathy with human progress. Minds and hearts “inevitably divide themselves between these two principles—movement and resistance.” Resistance in this sense, so firmly in place among the European powers after the defeat of Napoleon, saw itself undermined in the 1830s and 1840s and regularly threatened with revolution’s second coming. In a climate of anxiety, the response took various forms. In Britain—where the conservation principle was already finding new forms of scientific expression—Guizot’s hero, Robert Peel, recast the shaken resistance as a sensible braking force, now newly renamed “the Conservative Party.”<sup>5</sup>

## DOUBLE-ENTRY PHYSICS

Charles Brunold, writing on the history of the concept of entropy, has a point when he argues that the first law of thermodynamics, that of the conservation of energy, “is incontestably a law of our mind,” while the second law, despite its relative opacity, is “imposed upon us by the facts.”<sup>6</sup> For one thing, the first law implied a finite system. In the words of Helmholtz: “The universe has its definite store of force, which works in it under ever varying forms; is indestructible, not to be increased, everlasting and unchangeable like matter itself.”<sup>7</sup> Energy may metamorphose and/or circulate, but Energy is neither created nor destroyed (certainly not by Promethean Man). Energy may be mined, harnessed, released, may change shape endlessly, but in the conversion each unit of the fixed common



basis can be accounted for.

In an age that had harnessed and unleashed sources of stored energy that increased exponentially the power to do actual work—limited for ages to what wind, water, and muscle in man or beast could accomplish—the first law, postulating a rigorous economy of energy, could among other things neutralize the chaotic aspect of energy as the power to effect change. The power to effect change was itself subject to law. With the help of useful fictions like “potential energy” (available reserves of motion deferred), energy could be contained in an accounting system. In application, the first law worked like a company balance sheet, reckoning income and outgo, capital and expenditure, reserves and liquidity, where expenditures are turned into assets, assets into liabilities, and dissipation is converted into circulation. The sum of energy—finite by definition—passed from store to agent, agent to product, changed form constantly, and never diminished.

But there was a catch, a principle inherent in a simpler mode of reckoning: you can't have your cake and eat it too. The problem lay in the one-way nature of time and the related perception that energy, like water on its own, is given to flowing downhill. The machine that gains through expenditure, whose returns are in excess of investment, is impossible. Even worse, the quantity of water whose flow powers the pump—though it does not decrease—will never be enough to raise itself to its previous height. Except ideally (meaning theoretically, as a limiting case), a quantity of energy undergoing or effecting change cannot help but lose ground without external recruitment, cannot help but lose some capacity to effect further change. In the economy of an energy system, there is always a quantity of “lost work,” troubling alike to engineers and theorists. There are, in later language, “transaction costs.”

For one thing, some activity, meeting resistance, escapes into heat not recoverable for other purposes, and heat itself tends to equalize in a body or system, which means losing its ability to effect change. By the end of the century, some scientists were even prepared to challenge the good sense of still regarding dissipated heat as “energy” when it can no longer be transformed into mechanical effect.<sup>8</sup> But long before that, the factual intransigence of “lost work,” and the anomaly of “energy” with no capacity for work, imperiled the meaning of “conservation” despite the quantitative reasoning. So the first law acquired a necessary companion, to take account of such nonconservation, in the second law of thermodynamics. Beginning with the temporalized restrictions on convertibility, the second law siphoned off incremental dissipation, set up as it were a separate ledger for depletion. Eventually it acquired, along with the means for quantitative expression, the reifying power of a name, as “entropy.”

The coinage of Rudolf Clausius, entropy was intended to complement energy etymologically as well as physically. Where energy was understood as deriving from its Greek roots the signification of “work content,” entropy would signify “transformation content.” It was not to be a measure of capacity for further transformation, however, but rather quite the reverse. In Clausius's term as in his classic formulation, there were the seeds of confusion but also a totalizing magisterial simplicity that would have large implications for imaginations engaged with the fate of everything. “The energy of the universe is constant,” he wrote. “Its entropy tends to a maximum.”<sup>9</sup> The confusion for even

excellent scientists who first took up the term lay in giving entropy a positive value, since what “tends to a maximum” in the only permitted direction of change is in effect a universal running down.

The generalization of a tendency toward irreversible dissipation claimed an ancestry in the specific science concerned with heat and motion, notably in Sadi Carnot’s rediscovered *Reflections on the Motive Power of Heat* [Feu] (1824).<sup>10</sup> With the general acceptance of the view that heat was not a substance itself conserved (as Carnot believed) but simply a condition of matter and an effect of motion, the character of that motion asked to be considered. What, for example, made a small heat incapable of augmenting a greater heat, just as a small kick can add to the momentum of a rolling wheel or a small deposit add to a large balance? As Helmholtz himself reasoned later in the century, there was no help but to introduce the very quality that the first law in its systemic character had sought to banish. A kick is directional; its motion is coordinated and directional and as such can be called orderly. “Disorderly motion would then mean all motion in which the motion of each particle has no similarity to that of its neighbours. We have every reason to believe that heat-motion is of the latter kind, and one might in this sense regard entropy as the measure of disorder.”<sup>11</sup> Or, as a modern commentator puts it, first expressed as “a restriction on the possible transformations of heat and work,” the second law “is now seen as being fundamentally a statement about the increase of disorder in the universe.”<sup>12</sup>

Yet, even before such problematizing of the foundations, the logic of an irreversible incremental dissipation, of energy depletion in a qualitative sense, had begun to effect the most radical of the many historical transformations of the face of chaos. What emerged was no longer chaos as the apical extreme of energetic turmoil, chaos as war, chaos as revolution, chaos as the eruption of monstrous catastrophe, but chaos as the gradual, inexorable approximation of rest.

## THE DEATH OF THE UNIVERSE

It was also chaos on a new scientific basis. In 1852, William Thomson, later Lord Kelvin, delivered a short, startling paper to the Royal Society of Edinburgh called “On a Universal Tendency in Nature to the Dissipation of Mechanical Energy.”<sup>13</sup> Its object, he said, was “to call attention to the remarkable consequences which follow from Carnot’s proposition, that there is an absolute waste of mechanical energy available to man when heat is allowed to pass from one body to another at a lower temperature by any means not fulfilling his criterion of a ‘perfect thermo-dynamic engine’”—that is, in all actual circumstances. From the newly refounded dynamic theory of heat (heat as motion) on the one hand, which said you cannot recover spent mechanical energy from the heat of something no warmer than its surroundings, and from the conservation of energy principle on the other, which allowed of no additions to the existing store, Thomson thought to extrapolate to the largest of systems, the “thermo-dynamic engine” of the whole physical world. These were his general conclusions:

1. There is at present in the material world a universal tendency to the dissipation of mechanical energy.
2. Any restoration of mechanical energy, without more than an equivalent of dissipation, is impossible in inanimate material processes and is probably never effected by means of organized matter, either endowed with vegetable life or subjected to the will of an animated creature.
3. Within a finite period of time past, the earth must have been, and within a finite period of time to come, the earth must again be unfit for the habitation of man as at present constituted, unless operations have been, or are to be performed, which are impossible under the laws to which the known operations going on at present in the material world are subject.

Within months, the Glasgow scientist and engineer W. J. Macquorn Rankine took up Thomson's conclusions, attested their soundness, and offered an imaginative way out.<sup>14</sup> In a direct response to Thomson's paper, he reports it as showing that there is "a tendency towards a state in which all physical energy will be in the state of heat, and that heat so diffused that all matter will be at the same temperature; so that there will be an end of all physical phenomena." But Rankine speculates on another possible outcome: that at some "indefinitely distant period" the diffused energy may be reconcentrated, as it encounters the limits of the transparent interstellar medium—in effect the limits of the universe—and is reflected and reconcentrated into "foci" capable, for example, of rekindling an extinct star. Thus,

although, from what we can see of the known world, its condition seems to tend continually towards the equable diffusion, in the form of radiant heat, of all physical energy, the extinction of the stars, and the cessation of all phenomena; yet the world, as now created, may possibly be provided within itself with the means of reconcentrating its physical energies, and renewing its activity and life.

Rankine goes further, in a final speculation that these processes may go on simultaneously. He thus varies from a cyclically oscillating model (anticipating some twentieth-century hypotheses on the fate of everything) to a dynamic equilibrium model (on a principle favored by other nineteenth-century thinkers, like Herbert Spencer, concerned to accommodate countervailing tendencies of evolution and dissipation). A universe that is both infinitely expansive and infinitely self-renewing, as in Kant's grand vision, he can no longer reconcile with thermodynamic principle, but Kant's models nevertheless would be invoked in one of the greatest scientific arguments of the age, Thomson's thermodynamic challenge to the physical premises of Darwin's theory of evolution.

Rankine did not persist in his speculative flight from the logic of an inexorable descent into a diffused universal sameness, and in his subsequent "Outlines of the Science of Energetics," he quietly accepts the inevitable.<sup>15</sup> Thomson's conclusions had their own imaginative appeal as well as convincing physical support, and in a little more than a year after his original paper saw print, Helmholtz brought the news to a wider audience. Lecturing not as a scientist speaking to scientists but on a civic occasion, Helmholtz describes a universe whose total store of energy is divided into two parts: the heat that is no longer available and all the rest, where

the first portion of the store of force, the unchangeable heat, is augmented by every natural process, while the second portion, mechanical, electrical, and chemical force, must be diminished; so that if the universe be delivered over to the undisturbed action of its physical processes, all force will finally pass into the form of heat, and all heat come into a state of equilibrium. Then all possibility of a further change would be at an end, and the complete cessation of all natural processes must set in. The life of men, animals, and plants would not of course continue if the sun had lost his high temperature, and with it his light—if all the components of the earth's surface had closed those combinations which their

Helmholtz softens the blow—parenthetically—by crediting Thomson with seeing in Carnot’s law “consequences which threatened the universe, though certainly after an infinite period of time, with eternal death.” In taking up the more local and imaginable question of the fate of the earth, he considers the agents and indications of mortality: evidence for a resisting interplanetary medium in the decay of cometary orbits, the effect of the friction of the tides (“after millions of years” stilling the earth’s rotation), and above all the gradual depletion of the energy of the sun, to which Thomson would soon bring his colder intellectual fire. In the end, Helmholtz offers the odd consolation that the past history of the earth shows “what an insignificant moment the duration of the existence of our race upon it constitutes” (89), and moreover, there was every likelihood that geological disaster would bring on “the last day of the human race” before the slower-acting thermodynamic inevitabilities could do their worst.

Helmholtz thus evades the peculiarly distressing notion of the death of the universe through senile exhaustion and paralysis by offering—as comfort—a more familiar chaos of destructive convulsion full of elemental, geologic energy. He offers one other consolation, more elevating and flattering and certainly antientropic: knowledge. That of the light spun out of darkness by science itself, irradiating “the distant nights of the beginning and the end of the history of the universe.”

It was finally Clausius who seems to have brought the clearest historical understanding to the relation of the two laws of thermodynamics. When it comes to the universe, he says, one often hears that everything is a circuit, that when changes occur in one place, at one time, and in a certain direction, in another place and at another time changes will occur in the opposite direction, so that “in the long run the state of the world remains unchanged. Consequently, it is said, the world may go on in the same way forever.” The first law, he suggests, “may probably have been regarded as an important confirmation of this view,” and indeed, “it expresses the unchangeableness of the universe in a certain very important respect.” But as to the whole condition of the universe, it leaves something out: the implications of the “second fundamental theorem,” which distinctly preclude an endless recycling. These are that “the condition of the universe must gradually change more and more in a certain particular direction”; that the work the forces of nature are capable of performing, “contained in the existing motions of the bodies which make up the system of the universe, will be gradually converted more and more into heat”; and heat, “inasmuch as it always tends to pass from hotter to colder bodies, and so to equalize existing differences of temperature, will gradually acquire a more and more uniform distribution.” Further (and here Clausius’s reasoning carries him beyond Thomson or Helmholtz), “in relation to their molecular arrangement, material bodies will get nearer to a certain condition in which, regard being had to the existing temperature, the total disgregation is the greatest possible.” Restating his formula, “The entropy of the universe tends towards a maximum,” Clausius concludes with a Beckettian glimpse of the endgame:

The more the universe approaches this limiting condition in which the entropy is a maximum, the more do the occasions of further change diminish; and supposing this condition to be at last completely attained, no further changes could



## ANCESTRAL VOICES

The imagination of a cosmic condition where progressive dissipation has annulled all or almost all kinetic interaction did not have to wait for the invention of thermodynamics. Epicurus evokes it to exclude the possibility of a universe made up of finite matter in infinite space (“the void”). “For if the void were infinite and bodies finite, the bodies would not have stayed anywhere but would have been dispersed in their course through the infinite void.”<sup>18</sup> Through such dissipation, in the absence of kinetic interaction, all structure and differentiation would be lost. Epicurus’s point is that such a condition is plainly at odds with the observable reality but indubitably would have arrived (given unlimited duration) in the kind of universe he is disproving.

In eighteenth-century France, the great naturalist Buffon gave a history of the formation of the earth in his *Époques de la nature* (1779), tying its future as well as its past to its internal heat and coming refrigeration—an inevitable heat death, however deferred and qualified by the climate-changing actions of man. At about the same time, another savant, on good terms with Buffon and familiar with his earlier work, composed a philosophic “bagatelle,” as he called it, which specifically contemplates the extinction of the sun. Known as “The Ephemera” and written to the much younger Madame Brillon after a visit to the Moulin Joli (an island in the Seine), Benjamin Franklin’s gallant epistolary fable reports the sage musings of “a kind of little Fly, called an Ephemere, all whose successive Generations we were told were bred and expired within the Day”:

It was, says he, the Opinion of learned Philosophers of our Race, who lived and flourished long before my time, that this vast World, the Moulin Joli, could not itself subsist more than 18 Hours; and I think there was some Foundation for that Opinion, since by the apparent Motion of the great Luminary that gives Life to all Nature, and which in my time has evidently declin’d considerably towards the Ocean at the End of our Earth, it must then finish its Course, be extinguish’d in the Waters that surround us, and leave the World in Cold and Darkness, necessarily producing universal Death and Destruction.

A prodigy of longevity (having lived seven summer hours, with perhaps seven or eight minutes still in store), the ephemere reflects on the vanity of effort and achievement and even lasting fame; for “what will become of all History, in the 18th Hour, when the World itself, even the whole Moulin Joli, shall come to its End, and be buried in universal Ruin?”<sup>19</sup>

It is not easy to pin down Franklin’s witty fable, which is part of its delight. But along with the compliment to an intelligent amitié and the Solomonic descant on the vanity of human ambitions (with the hinted invitation to make the most of the moment), the fable pleasantly ridicules the scientific opinion that the ephemere so plausibly supports. Reports of the immanent death of the world are, it seems, greatly exaggerated. Mortality and dissolution, in “the Course of Nature,” strike down the single life and even the polity (the sage expects that the present race of ephemerers will, in minutes, “become corrupt like those of other and older Bushes, and consequently as wretched”), but the cycling permanence of Nature and the cosmos is another matter. Franklin here, as a man of the eighteenth century, appears,

cosmologically at least, more mainstream than revolutionary.

Buffon's own views, reaching print in the *Époques* the following year, had recently changed. A few years earlier he had expounded a view of the cosmos that celebrated its inertial stability, and he had included the theory of a wheeling solar system whose motion generated heat and light, guaranteeing that the sun, "This fertile source of light and life will never be exhausted."<sup>20</sup> Buffon retained a belief in a sustaining balance of forces in the universe at large, but by the time of the *Époques de la nature*, he had come to believe that the earth nevertheless would die of cold, since "The heat conveyed to the earth by the sun...would not alone be sufficient to support animated nature." The earth, once molten, was imperceptibly cooling, and having reached a habitable temperature some 72,000 years earlier, "an equal portion of time must elapse before it is so cold as to be unfit for the nourishment of animals and vegetables."<sup>21</sup> Both the issue of the sun's energy as a renewable or depleting resource and the earth's internal heat and cooling as an index to its lifespan would return to stage center in the next century, but speaking the language of thermodynamics.

In the interval, however, in a radically different climate of thought and feeling, Shelley's avid scientific imagination absorbed *The Epochs of Nature*. Awed by the glaciers of the Alps, their destructive power and apparently inexorable advance, he recalls Buffon's "sublime but gloomy theory—that this globe which we inhabit will, at some future period, be changed into a mass of frost by the encroachments of the polar ice, and of that produced on the most elevated points of the earth." And he writes in "The Triumph of Life" of "the great Winter" that will "lay the form and name / Of this green earth...for ever low."<sup>22</sup> In a similar spirit, Byron's startling poem of 1816 "Darkness" envisages the consequences of the extinction of the sun, in "a dream which was not all a dream." The death of the sun appears sudden and catastrophic, however, rather than as the result of a slow, inevitable decay. The rapid disintegration that follows, on "the icy Earth...blind and blackening," is above all social and structural collapse, with famine and conflagration leading men and cities (and the only somewhat less rational animals) to hasten their own extinction. The poem permutes traditional apocalyptic imagery, but the end state is one that the imaginative writers of the *fin de siècle* and after—Wells, Flammarion, Beckett—could hardly improve upon as a vision of terminal entropy:

The World was void,

The populous and the powerful was a lump,  
Seasonless, herbless, treeless, manless, lifeless—  
A lump of death—a chaos of hard clay.  
The rivers, lakes, and ocean all stood still,  
And nothing stirred within their silent depths;  
Ships sailorless lay rotting on the sea,  
And their masts fell down piecemeal: as they dropped  
They slept on the abyss without a surge—  
The waves were dead; the tides were in their grave,  
The Moon, their mistress, had expired before;  
The winds were withered in the stagnant air,  
And the clouds perished; Darkness had no need  
Of aid from them—She was the Universe.<sup>23</sup>

Byron's poem extends a dark strain in post-Revolutionary feeling, as much historical as eschatological, a strain that appears in the numerous representations, from Volney's *Les ruines* forward,<sup>24</sup> of solitary figures brooding over a desolate waste, the trace of empires brought low by catastrophe or the decadence that leads to catastrophe. Mary Shelley's *Last Man* (1826) varies the causation in projecting the death of the world, or at least of all mankind, through a universal plague, but the dominant trope in her novel is still that of unanticipated catastrophe.<sup>25</sup> The potent "School of Catastrophe" in the art, literature, and popular theater of the earlier nineteenth century most commonly took its cue from biblical models, even where the subject was secular (e.g., *Pompeii*). Nevertheless, in the work of some artists, such as the painter John Martin, scientific views of the history of the earth also left their mark, notably the arguments of Georges Cuvier and those geological reasonings upon the evidence of formidable "Plutonic" and "Neptunian" activity in the past subsumed in the 1830s under the label of "Catastrophism." Undoubtedly the appetite for catastrophic fantasy was greatly spurred by Cuvier's grand overview and argument, the *Discours préliminaire* to his work on large fossils (1812), where he reads the past from its physical remains as a series of great terrestrial catastrophes, the latest some six thousand years ago. Widely translated, it came into English in 1813 as an *Essay on the Theory of the Earth*.<sup>26</sup> Byron echoes it in the cosmic retrospect of lost and alien worlds that *Lucifer* offers in *Cain* (1821). Confronted with the shades of the earth's former glories and its vanished mighty inhabitants—*Lucifer* hints at the succession of species—*Cain* asks how such a thing could come about. *Lucifer* replies:

By a most crushing and inexorable  
Destruction and disorder of the elements,  
Which struck a world to chaos, and a chaos  
Subsiding has struck out a world: such things,  
Though rare in time, are frequent in eternity.<sup>27</sup>

The provocatively unaddressed question here is how these two orders—time (historical) and eternity—relate. What, concretely, are the dimensions, the confines, of time when mapping the one upon the other? And how does one take their measure?

## A QUESTION OF TIME

The science of geology acquired its name and its modern foundations in the century between 1750 and 1850, and given that the earth, with a physical history of its own, was necessarily the platform on which the drama of organic life played out, geology found itself both surrogate target and battleground when William Thomson brought his reach and authority in the physical sciences to bear on Darwin's evolutionary biology. By then, geological "catastrophism," the dominant school in the Romantic period, had been largely eclipsed by "uniformitarianism." Both terms were the coinage of William Whewell in a critical 1832 review of Charles Lyell's *Principles of Geology*, the treatise that, by virtue of its powers of synthesis and clarifying impetus in a heterogeneous field, would establish itself as the Uniformitarian bible.<sup>28</sup> Darwin was then able to rest his great account of the

evolutionary process in organic life on the foundations of modern geology as embodied in Lyell, that is, upon the geology thanks to which, as T. H. Huxley put it, “the abyss of time began to loom as large as the abyss of space.”<sup>29</sup> Cuvier had earlier exclaimed, “Genius and science have burst the limits of space and...have unveiled the mechanism of the universe. Would it not also be glorious for man to burst the limits of time[?]. . .and why should not natural history also have one day its Newton?”<sup>30</sup> But Cuvier’s time was constrained, at least for the most recent phase of the earth’s history, by a roughly biblical chronology, allowing no time for gradual transformation, either of species—which he believed invariable—or of continents. For the slow processes of natural selection as the key to speciation and change, Darwin needed an “abyss of time,” one that the patient fossil writing in the rocks and a gradualist explanation of their succession could supply.

“Gradualist” could as easily have been the summary tag as “uniformitarian” for the school of Lyell and his pioneering predecessors, James Hutton and John Playfair, except that “uniformitarian” asserted a methodological and indeed philosophical premise. This was that the processes at work today are the only fit instrument for interpreting the geological past and that a theory of the earth (in Hutton’s words) “can have no retrospect to that which had preceded the present order of the world; for this order alone is what we have to reason upon.” As T. H. Huxley was obliged to admit, Hutton, who laid the disciplinary groundwork at the end of the eighteenth century, was no evolutionist but saw in the stable, compensatory system of the heavens, confirmed by French celestial mechanics, a model for the system of the earth, a “succession of worlds” whose processes revealed “no vestige of a beginning,—no prospect of an end.”<sup>31</sup> Nevertheless, Hutton’s slow processes of crustal erosion and deposition in the depths of the sea, consolidation of the sediments, their elevation, subjection to plutonic forces and intrusions, and then new erosion and sedimentation, in endless cycle, offered a lodgment for theories of evolution, stratigraphic or bioform, without temporal constraint.

In 1862, William Thomson, having looked to the end of things a decade earlier, turned his attention to beginnings. Three years after *The Origin of Species*, he published an essay in *Macmillan’s Magazine* whose intent clearly included the desire to challenge Darwin and his supporters on their premises before a large public. He did so by confronting the immense tracts of time that evolution through natural selection required with the temporal limits derived from physical law, notably thermodynamics. Selecting from among the several problematic assumptions in the evolutionists’ generous construction of geological time, he focuses here “On the Age of the Sun’s Heat.”<sup>32</sup> By eliminating chemical combustion or meteoric renewal (a theory he had earlier embraced) as adequate energy sources, Thomson bases his estimates on the radiant energy of an incandescent mass whose heat derives from initial coalition and gravitational contraction. Calculating from the probable rate of cooling and the constraining limits on the sun’s initial and specific heats, Thomson concludes that it is “on the whole most probable that the sun has not illuminated the earth for 100,000,000 years” (393). With an eye to this relative brevity, he asks, “What then are we to think of such geological estimates as 300,000,000 years for the ‘denudation of the Weald’?” And, getting personal, “Whether it is more probable that the physical conditions of the sun’s matter differ 1,000 times more than dynamics compel us to suppose they differ



from those of matter in our laboratories; or that a stormy sea, with possibly channel tides of extreme violence, should encroach on a chalk cliff 1,000 times more rapidly than Mr. Darwin's estimate of one inch per century?" (391–392).<sup>33</sup>

In the introduction to his mostly expository article, after stressing the unassailable authority of "the second great law of Thermodynamics" and its "irreversible action in nature," whose result "would inevitably be a state of universal rest and death," Thomson risks inconsistency to qualify the harshness of the sentence. He informs his readers that, in a universe with no conceivable limits, science points to an endless progress through an endless space rather than to "a single finite mechanism, running down like a clock, and stopping for ever" (388). Moreover, with the need for an overruling creative power to account for life in the first place, "no conclusions of dynamical science regarding the future condition of the earth, can be held to give dispiriting views as to the destiny of the race of intelligent beings by which it is at present inhabited" (389). But he concludes with the certainty that these same inhabitants of the earth "cannot continue to enjoy the light and heat essential to their life, for many million years longer, unless sources now unknown to us are prepared in the great storehouse of creation" (393).<sup>34</sup>

A month later, Thomson invoked a second physical ground for faulting the uniformitarian time scale in a paper read to the Royal Society of Edinburgh, "On the Secular Cooling of the Earth."<sup>35</sup> Here, reasoning from irreversible dissipation, the increase of temperature with depth in the earth, and the implication of continual heat loss through conduction outward, Thomson presents the probability of a (hotter) catastrophic past, and, in passing, he openly scoffs at Lyell for proposing an internal economy for the earth of perpetually cycling electrochemical renewal as being no less fanciful and at odds with physical law than a perpetual-motion clock. He arrives at wide outer limits for the consolidation of the earth—between twenty and four hundred million years ago (300)—not to be confused with habitability. And he sets the stage for his all-out challenge, delivered in 1868 in the very citadel of error, as an address to the Geological Society of Glasgow: "On Geological Time."<sup>36</sup>

Calling for "a GREAT reform in geological speculation," Thomson adds to his arguments on the age of the sun's heat and the cooling of the earth those from frictional resistance, notably the retarding effects of the tides on rotation. Beginning with a "celebrated" and extensive passage from Playfair's redaction of Hutton declaring, among other things, that "the Author of nature has not given laws to the universe, which, like the institutions of men, carry in themselves the elements of their own destruction," Thomson observes, "Nothing could possibly be further from the truth" (12). British popular geology, he finds, "at the present time is in direct opposition to the principles of natural philosophy" (44). Far from there being, as Playfair put it, no permitted sign in God's works "by which we may estimate either their future or their past duration" (12), the earth, Thomson asserts, "is filled with evidences that it has not been going on forever in the present state, and that there is a progress in events towards a state infinitely different from the present" (44). Looking forward, to the long-term effects of tidal friction on the earth's rotation, he projects a cessation of the motion of the earth relative to the moon; looking back, to a sun expending its heat and an earth cooling from the liquid state, he concludes that "the existing state of

things on the earth, life on earth, all geological history showing continuity of life, must be limited within some such period of past time as one hundred million years” (64).

The gauntlet having been flung down, the redoubtable Thomas Henry Huxley rose to the defense of fair Geology. In a parallel venue one year later, Huxley delivered his presidential address to the Geological Society of London on the subject of “Geological Reform.”<sup>37</sup> Using courtroom metaphors and tactics for his refutation of Thomson’s charges against the profession, he dismisses the probative conclusiveness of Thomson’s temporal estimates even if correct. He argues the vagueness of their upper and lower limits and (correctly as it happens) the likelihood of crucial unknowns—he also adds that with no absolute time scale written in the geological record, “one or two hundred million years might serve the purpose, even of a thorough-going Huttonian uniformitarian, very well” (278). Rebuttal of the factual argument is not where Huxley begins, however. He repudiates the notion that geological thought is monolithic and instead lays out “three, more or less contradictory, systems,” all with something to be said for them (252). To catastrophism and uniformitarianism in their hardened opposition, he adds evolutionism, which, like evolution itself, “embraces all that is sound in both Catastrophism and Uniformitarianism, while it rejects the arbitrary assumptions of the one and the, as arbitrary, limitations of the other” (267). Rather too neatly, he characterizes the one (catastrophism) as insisting on “the existence of a practically unlimited bank of force” and the other (uniformitarianism) as insisting upon “a practically unlimited bank of time,” and he finds no necessary theoretical antagonism between them. But his defense is much more attentive to uniformitarianism and its secular continuities, and his own evolutionistic disposition to relate inorganic and organic processes leads him to foreground Hutton’s venture beyond considering the earth “merely as a machine” when accounting for its durability. “May it not be also considered as an organized body?” Hutton had asked, “such as has a constitution in which the necessary decay of the machine is naturally repaired, in the exertion of those productive powers by which it had been formed”? (256). On the other hand, under the cover of an appeal for a speculative “geological aetiology,” Huxley invokes Kant’s cosmogony as a kind of progressive catastrophism:

In vivid language he depicts the great world-maelstrom, widening the margins of its prodigious eddy in the slow progress of millions of ages, gradually reclaiming more and more of the molecular waste, and converting chaos into cosmos. But what is gained at the margin is lost in the centre; the attractions of the central systems bring their constituents together, which then, by the heat evolved, are converted once more into molecular chaos. Thus the worlds that are, lie between the ruins of the worlds that have been and the chaotic materials of the worlds that shall be; and, in spite of all waste and destruction, Cosmos is extending its borders at the expense of Chaos.

(264)

Kant’s expanding universe, like Hutton’s organic analogy, appeals to Huxley in opening the way for evolutionary schemata that transcend any particular content or discipline.

Nor is the value of the doctrine of Evolution to the philosophic thinker diminished by the fact that it applies the same method to the living and the not-living world; and embraces, in one stupendous analogy, the growth of a solar system from molecular chaos, the shaping of the earth from the nebulous cubhood of its youth, through innumerable changes and immeasurable ages, to its present form; and the development of a living being from the shapeless mass of protoplasm we call a germ.

Moreover, not only is evolutionary succession a way of ordering a complex dynamic reality; it also gives positive value to the direction of time. Time here is not a measure of depletion and dissolution, of the clock of the cosmos running down, but of cosmic advance “at the expense of Chaos.”

Thomson returned to the charge six weeks later, once more addressing the Geological Society of Glasgow.<sup>38</sup> Huxley had laid on him the burden of proving geology’s derelictions, and he responds by quoting from textbooks and treatises, culminating in the latest edition (1868) of Lyell’s *Principles of Geology*. He quotes a long passage wherein Lyell invokes the convertibility of forces and implicitly the conservation law to counter “this theory of the constant diminution from age to age” of the sun’s power. For Thomson, it is the clinching example of geology’s “same tendency to overlook essential principles of thermodynamics,” that is, the second law (108–109). Consequently, it is no sounder than “Kant’s hypothesis of the restoration of a new chaos, like the old one, with potential energy for a repetition of cosmogony.” The “new chaos” that the second law projected was precisely not chaos recharged but chaos gone flat.

Thomson claims that his own geological training, before “the ultra-uniformitarianism of the last twenty years,” embodied the fundamental theory that Huxley now calls evolutionism (77) and that “the Catastrophism of Leibniz, Newton, Sedgwick...and many other true geologists” was nothing less than that same “‘evolutionism’” (111). But the crux of his forensic replication on the basic issues raised in his original charge, “On Geologic Time,” lies in his rejection of Huxley’s breezy reassurance that “if the geological clock is wrong, all the naturalist will have to do is to modify his notions of the rapidity of change accordingly.” Thomson refuses to accept the view that such a correction would be a trivial matter for what he calls “biological speculation.” “The limitation of geological periods, imposed by physical science, cannot, of course, disprove the hypothesis of transmutation of species; but it does seem sufficient to disprove the doctrine that transmutation has taken place through ‘descent with modification by natural selection’” (89–90).

The argument did not end there, and it has a special place in the history of science as an episode in which two powerful disciplinary constructs at odds—not simply unreconciled, like quantum theory and relativity, but seeming to invalidate one another’s premises and conclusions—continue in force in their respective disciplines because they are so genuinely productive and richly self-validating. Thomson’s thermodynamic case against the geologic time required by the Darwinians ought to have been a true sticking point, resting as it does on physical “law” and the authority it has carried since Newton, combined with an audit of energy supplies and expenditures that is if anything generous in its estimates. Even on the Huttonian principle of reasoning strictly from the world we know, Thomson has the better arguments. But of course his case collapses with the outing of what he had no way of knowing: radioactive decay as a measure of the age of the earth (as well as contributing to its heat) and fusion as fueling the sun.

In 1897, ironically less than a year after Henri Becquerel’s discovery of radioactivity in uranium, Thomson (now Baron Kelvin) spoke once more on “The Age of the Earth as an

Abode Fitted for Life.” In this presidential address to the Victorian Institute in London, he reviews the whole long debate and declares that his conclusions, now as then—now refined through experimental investigation—suffice “to sweep away the whole system of geological and biological speculation demanding an ‘inconceivably’ great vista of past time, or even a few thousand million years.”<sup>39</sup> Ten years earlier he had revisited the questions surrounding the source and duration of the sun’s radiant heat and concluded “it would...be exceedingly rash to assume as probable anything more than twenty million years of the sun’s light in the past history of the earth, or to reckon on more than five or six million years of sunlight for time to come.”<sup>40</sup> It was the fact of limitation and secular mortality, however, not the odd one or ten million years in the Damoclean death sentence, that, as the century drew to a close, depressed the spirits and stimulated the imagination to consider one’s end. Even Darwin, reflecting toward the end of his life on his present inability to summon up feelings that connect to a belief in God—and with it, immortality—could write with respect to the latter:

Nothing shows me how strong and almost instinctive a belief it is, as the consideration of the view now held by most physicists, namely that the sun and all the planets will in time grow too cold for life, unless indeed some great body dashes into the sun and thus gives it fresh life.—Believing as I do that man in the distant future will be a far more perfect creature than he now is, it is an intolerable thought that he and all other sentient beings are doomed to complete annihilation after such long-continued slow progress.<sup>41</sup>

## A SENSE OF DIRECTION

If the issue between thermodynamics and evolution was about available time, that was because a linear, historicized, and directionally constrained time was so material to both these sciences. The issue itself was directional in a qualitative sense. Was the underlying thrust and the movement of the whole toward increasing order or away? Toward increasing chaos or away? There were other issues in the dialogue that bore on how one conceived chaos. These lay in the unsettled status of alternative attributes of perceived reality, such as complexity and simplicity, differentiation and homogeneity, integration and autarchy, and these too became directional when tied to the question of the hour, or rather the century: What is Progress?

In proto-Darwinian thought, with the earth rather than the heavens as the proffered text, progress was read in the stones and sediments as a narrative of increasing complexity. In his immensely popular *Vestiges of the Natural History of Creation* (1844), Robert Chambers argues a law of development at work in the organic world comparable to that of gravitation in the inorganic. Defining “high” development as “attaining...at once a more complex and concentrated organization,” he observes of the earlier fossil-bearing layers, “It is most remarkable how uniform has been the Fauna of the earth in those primitive ages” and attributes the lack of variation to the comparative newness of life on the earth “and its little experience of those external agencies by which it is liable to be affected, and which, we shall see reason to believe, have operated in producing many shades of variation which now mark the organic kingdom.”<sup>42</sup> The admired astronomer, educator, and science writer John Pringle Nichol, musing in his *System of the World* (1846) on how to interpret the fits and starts of the fossil record as “progress,” points to one “indubitable symptom”: that



“vertebrated animals of rising functions, and a growing concentration of brain, somewhat regularly, and in due succession, come upon the scene.”<sup>43</sup> Nichol elsewhere had observed that “the most striking characteristic of this modern Age is its unresting activity, and the rapidity of its transitions” and included his own chosen discipline in “the universal instability.”<sup>44</sup> But here, under the rubric “Idea of Progress,” he concludes, “that the Universe is in a state, not of change merely, but of development,—that it is unfolding a grand, though unknown plan, we believe, in obedience to infallible instincts” (System, 217).

A law of development that linked succession with increasing complexity was a means whereby the stirring changes and expanding power to effect change in society that came with technological and scientific advance could find a rationale in nature. To find such a rationale is the ambition declared in the title of Herbert Spencer’s essay, published two years before the *Origin of Species*, as “Progress: Its Law and Cause.”<sup>45</sup> Subsequently elaborated into a philosophy committed to synthesizing social and scientific understanding, it made its author into one of the secular high theologians of the Victorian era as well as one of the founders of modern sociology and psychology. In the 1857 essay, where “progress” rather than “evolution” is still the watchword, Spencer begins his investigation by drawing on recent models of embryonic development. German science (notably that of Karl Ernst von Baer) had shown that from seed to tree, ovum to animal, the changes “constitute an advance from homogeneity of structure to heterogeneity of structure,” from uniformity of substance in texture and chemical composition to differentiation. “It is settled beyond dispute that organic progress consists in a change from the homogeneous to the heterogeneous. Now, we propose in the first place to show, that this law of organic progress is the law of all progress” (446). With sweeping panache, Spencer includes the geologic and climatic evolution of the earth, life on its surface, the evolution of society, government, manufactures, commerce, languages, literature, science itself, and art. He calls in the nebular hypothesis, the probable evolution of a solar system from what was originally “an indefinitely extended and nearly homogeneous medium” (447). He gives a Lamarckian account of the adaptive elaboration and differentiation of species and of the evolution of human societies toward greater heterogeneity, diversity, and complexity. He sees the “advance of Man towards greater heterogeneity” both in biological terms—specifying the greater differentiation of Europeans from the general archetype—and in social, political, and economic terms, from the emergence of chieftainship to industrial organization and the division of labor. He locates the impelling force for heterogeneous differentiation in the proposition that “every change is followed by more than one other change” (474), a chain reaction of multiplying effects with an exponential increase in systematic complexity as well as in distinctive individuation. He illustrates with a magnificent passage on “the latest embodiment of steam-power—the locomotive engine,” a Homeric catalogue of the ways in which this “proximate cause of our railway system, has changed the face of the country, the course of trade, and the habits of the people” (481). It is this inescapable “multiplication of effects” that he identifies as “the cause of progress in general, so far as we have traced it” (471).

In this immensely ambitious essay, Spencer proposes “that the Universe at large, like every organism, was once homogeneous; that as a whole, and in every detail, it has

unceasingly progressed towards greater heterogeneity,” and he envisages no end to this process. He certainly raises no alarms that the process might exhaust itself, reverse itself, or even reach a limit, and it never troubles him that expended and divided force might be irretrievably dissipated force. Thus, he concludes (except for a final word on religion and science):

It will be seen that as in each phenomenon of to-day, so from the beginning, the decomposition of every expended force into several forces has been perpetually producing a higher complication; that the increase of heterogeneity so brought about is still going on, and must continue to go on; and that thus Progress is not an accident, not a thing within human control, but a beneficent necessity.

(484)

Spencer, throughout his long working life, had the conversation, advice, and critical interest of scientists of the order of Huxley and Tyndall, Thomson and Maxwell. Apparently it was through a brace of conversations with Tyndall not long after his essay appeared that the question arose of a final state of things, in lieu of endless universal progress.<sup>46</sup> Spencer had already been meditating upon the work that would develop his essay into an all-embracing evolutionary philosophy. His answer to Tyndall was that he had all along recognized “the tendency to ultimate equilibrium.” But, as he wrote, “that which was new to me in your position enunciated last June, and again on Saturday, was that equilibration was death. Regarding, as I had done, equilibration as the ultimate and highest state of society, I had assumed it to be not only the ultimate but also the highest state of the universe.” Staggered, he says, and much unsettled, he hopes for further discussion.<sup>47</sup>

By the time the last of the serial installments of *First Principles* appeared in June 1862, Spencer had found it necessary to reformulate his universal schema at least to acknowledge the thermodynamic countercurrent. As recently as March and April of that year, Thomson had launched his two challenging papers, “On the Age of the Sun’s Heat” and “On the Secular Cooling of the Earth.” In May, Spencer reported having “a good deal of trouble” revising “Equilibration,” the last chapter before his concluding summary.<sup>48</sup> In the text that resulted, Spencer finds a place for the diffusion of heat, light, electricity, and the dissipation of motion. “That is to say, these motions undergo division and subdivision; and by continuance of this process without limit, they are, though never lost, gradually reduced to insensible motions.”<sup>49</sup> And he eventually asks the hypothetical question:

If Evolution of every kind, is an increase in complexity of structure and function that is incidental to the universal process of equilibration—if equilibration, passing through the gradually-perfected forms of moving equilibrium, must end in complete rest; what is the fate towards which all things tend? If the bodies constituting our Solar System are slowly dissipating the forces they possess—if the Sun is losing his heat...if geologic and meteorologic processes cannot but diminish in activity as the Sun’s radiations diminish...if Man and Society, however high the degree of evolution at which they arrive...equally with the lowest, terrestrial life, must eventually dwindle and disappear; are we not manifestly progressing towards omnipresent death? And have we thus to contemplate, as the out-come of things, a universe of extinct suns round which circle planets devoid of life?

(471–472)

Spencer answers himself, “That such a state must be the proximate end of the processes everywhere going on, seems beyond doubt.” But he goes on to question whether such a state would be truly final. Through a mixture of casuistry (on the legitimacy of some kinds of

statements about futurity), conjecture, and ingenious scientific argument, he opens the way to an unending succession of “alternate eras of Evolution and Dissolution,” a reversible sequence of integrating matter and disintegrative motion, turning on “that complete integration and equilibration which in other cases we call death” (482).

With time and revision, the distributive phase took on greater importance in Spencer’s outline, though still accompanying a vision of alternating eras and successive worlds. In the first edition of *First Principles*, the prospect of limits on evolutionary progress, the postevolutionary phase of dissolution, and the threat of a universal cessation are all subsumed in the chapter called “Equilibration.” But in later editions, starting in 1867, a separate chapter takes up the reciprocal character of “Evolution and Dissolution.”<sup>50</sup> And between “Equilibration” and the final summary, Spencer feels obliged to insert, in its logical position but in the spirit of an afterthought, a further overview of terrestrial and cosmic futurity titled simply “Dissolution.” It is not a matter Spencer wants to dwell on. Nevertheless, what is telling and even representative in Spencer’s own evolution is, first, the investment of the positive impetus captured in the idea of progress in a broader and more scientific concept of orderly change, termed evolution, and, then, the erosion of that positive legacy as the century progressed and the notion of evolutionary change absorbed the news of an irreversible tendency in the scheme of nature as a whole toward dissolution. Progress would end not in a “moving equilibrium,” self-sustaining like a mature society, person, or solar system, but in a final one. Spencer’s starting point—the law of the conservation of energy, yoked to a law of the multiplication of consequences, intended and unintended, over time—proved a feeble reed as a foundation for unlimited progressive change (increasing differentiation, definition, complexity, concentration, organization), since the costs, both distributive and transactional, were left out. At best, conservation (Spencer preferred to speak of the “persistence of force”)<sup>51</sup> can only conserve, not augment, the available power to act. The aspiration to unite the two great synthesizing generalizations of nineteenth-century science, evolution and energy, to apply evolutionary models to all phenomena manifesting continuity and change and to ground developmental succession in physical law, was perhaps inevitable. But then it was equally inevitable that the directional, time-bound partner of the law of the conservation of energy, the law of entropy, would also assert its rights.

Spencer’s considerable effort to neutralize and transcend the shadow of the second law did not, however, exempt him from contributing to its imaginative impact or from wrestling with some of its deeper implications. His characterization of dissolution as what happens when the force (energy) contained in coherent, organized matter passes into incoherent molecular motion, and his uneasy, bipolar account of the tendency in all things to equilibration, would connect in the developments that gave entropy a less deterministic but no less rigorous ground as the road to an elemental chaos. From the work of Ludwig Boltzmann and James Clerk Maxwell in the 1870s on molecular behavior and its statistical distribution in gases, Thomson’s “Universal Tendency in Nature” and Clausius’s law of entropic maximalization would emerge, reformulated, as the universal tendency to move from less probable to more probable states, or (somewhat paradoxically) to an increasing randomness on the molecular level and to a thermodynamic leveling—equilibrium—in the

aggregate. It is here that “entropy” as a progressively manifest underlying condition and as a prospective terminal state achieves its full flavor as the imagined shape of chaos. That is, having started out simply as a measure of the unavailability of energy in a closed system and then become the law that expresses the direction and qualitative depredations of time, entropy—the tendency reified in the word—achieves a potent imaginative synthesis. For in uniting a multiplying randomness with an aggregate inertness in a scientifically grounded vision of the universal destiny, entropy claimed a place in the nightmares of the later nineteenth and subsequent twentieth centuries as the fate wherein the featureless chaos of nothing and the multitudinous chaos of number were finally joined.

## SECOND THOUGHTS

In the fin-de-siècle visions of an approach to terminal chaos, sudden catastrophe and entropic decline often share the stage while evolutionary gradualism and thermodynamic decay succeed in making their peace. Indeed, the shadow of the physical law reinforced a social anxiety about “decadence” biologically and culturally understood. Evolutionary anxieties and thermodynamic inevitabilities collaborated in the pessimism that found powerful expression after 1870, in the wake of military disaster in France, political instability there and elsewhere, persistent economic depression and social unrest, environmental degradation, and the internal and external seismic stresses that eventually erupted in the Great War. Both Zola and Wells, for example, unite the physical and the biological in their imaginings of contemporary and prospective chaos, as do Henry Adams and many others. Indeed, no “pure” attempt to represent the chaos of entropy in a literary work without some tincture of the evolutionary legacy is known to me before Beckett, and even he makes the connection in *Waiting for Godot* via Lucky’s great tirade embracing “Anthropopopometry.”

The accommodation between energy science and evolutionary science also, eventually, emerged in the public ministry of T. H. Huxley. If Thomson stuck to his guns well into the nineties, Huxley did not, and his qualms about a Spencerian religion of progress founded on evolutionary adaptation and competition emerged, together with an acknowledgment of thermodynamic considerations for a species (our own) able to bring ethical consciousness to bear on the processes of nature. The year was 1887, the impetus both public and personal, and Huxley’s metanoia is made vivid in the contrast between two invited performances: one, an essay on “The Progress of Science 1837–1887” commissioned for the Jubilee publication *The Reign of Queen Victoria*; the other, an address to a general Manchester audience entitled “The Struggle for Existence in Human Society.”

In the Jubilee essay, Huxley names the three great products of an age unmatched in scientific achievement, all intimately connected and each applicable to the whole physical cosmos: the doctrine (as he calls it) of the constitution of matter, the doctrine of the conservation of energy, and the doctrine of evolution. His account of thermodynamic theory dwells only on the conservation law, though he attaches an ambiguous afterthought: “It follows that energy, like matter, is indestructible and ingenerable in nature. The phenomenal world, so far as it is material, expresses the evolution and involution of energy, its passage



from the kinetic to the potential condition and back again. Wherever motion of matter takes place, that motion is effected at the expense of part of the total store of energy.”<sup>52</sup> The last sentence is as close as he comes to acknowledging the second law of thermodynamics, but there is no thought here beyond excluding possible recruitment from a source outside nature.

The Jubilee year was also marked by much social and political unrest with, in the fall, mass meetings of the unemployed in London and bloody clashes with the police. Also that fall, after great suffering under the shadow of mental illness, Huxley’s talented and much loved daughter Mady died of pneumonia. To stand helpless before such suffering, and to share it profoundly, while coming to see a mountain of misery as the fruit of industrial progress, can shake one’s confidence in nature’s plan. A few weeks after Mady’s death, Huxley delivered his promised address in Manchester, bending his talk, however, whose working title had been “Programme of Industrial Development,” into the first of a series of attempts to come to terms with “the apparent paradox that ethical nature, while born of cosmic nature, is necessarily at enmity with its parent.”<sup>53</sup> Forcefully ridiculing the argument that one can take comfort from the reflection that “the terrible struggle for existence tends to final good, and that the suffering of the ancestor is paid for by the increased perfection of the progeny,” he points out that it is an error to imagine that evolution signifies a constant tendency to increased perfection. Rather it involves a constant remodeling through adaptation to new conditions, whatever they are, so that:

Retrogressive is as practicable as progressive metamorphosis. If what the physical philosophers tell us, that our globe has been in a state of fusion, and, like the sun, is gradually cooling down, is true; then the time must come when evolution will mean adaptation to an universal winter, and all forms of life will die out, except such low and simple organisms as the Diatom of the arctic and antarctic ice and the Protococcus of the red snow. If our globe is proceeding from a condition in which it was too hot to support any but the lowest living thing to a condition in which it will be too cold to permit of the existence of any others, the course of life upon its surface must describe a trajectory like that of a ball fired from a mortar; and the sinking half of that course is as much a part of the general process of evolution as the rising.<sup>54</sup>

Huxley assigns neither range nor velocity to his imagined trajectory, since in fact his concern is in the present: with the world of competing industrial states where, among a vast mass of people in every European manufacturing city of any size, “la misère reigns supreme”; where many more are poised on the edge; and where, “with every addition to the population, the multitude already sunk in the pit and the number of the host sliding towards it continually increase.” He does not believe that societies “in which the elements of decomposition are thus swiftly and surely accumulating can hope to win the race of industries” (216). He holds to the inevitability of a Darwinian, indeed Malthusian competition between industrial societies but challenges the need for starvation wages and warns that where a given social order plainly makes for evil and not for good, men will think it high time to begin a fresh experiment, and “animal man, finding that the ethical man has landed him in such a slough, resumes his ancient sovereignty, and preaches anarchy; which is, substantially, a proposal to reduce the social cosmos to chaos, and begin the brute struggle for existence once again” (215).

Though Huxley invokes retrogressive metamorphosis to make a social point, the subject

of biological “degeneration” had come to the fore in recent scientific studies, attracting interest. In 1880, E. Ray Lankester published *Degeneration: A Chapter in Darwinism*, an intentionally sobering statement challenging assumptions on evolutionary progress and “ascent.”<sup>55</sup> Lankester blames habits of classification, from “lower” to “higher,” for predisposing naturalists to see only stability and evolutionary improvement in species and credits Anton Dohrn as the only naturalist so far to have put forward “Degeneration as capable of wide application to the explanation of existing forms of life.”<sup>56</sup> Lankester defines “Degeneration” (as opposed to “Elaboration”) as change in the structure of the organism whereby it “becomes adapted to less varied and less complex conditions of life.” And he ties it to the energy economy. Whereas in “Elaboration there is new expression of form, corresponding to new perfection of work in the animal machine,” in Degeneration there is “suppression of form, corresponding to cessation of work.”

The applicable contemporary threat Lankester has in view is the possibility of the degeneration of, if not the whole human species, at least some parts of it, including “the white races of Europe”—not just physically but culturally, intellectually, even linguistically. He points out:

In accordance with a tacit assumption of universal progress—an unreasoning optimism—we are accustomed to regard ourselves as necessarily progressing, as necessarily having arrived at a higher and more elaborated condition than that which our ancestors reached, and as destined to progress still further. On the other hand, it is well to remember that we are subject to the general laws of evolution, and are as likely to degenerate as to progress. As compared with the immediate forefathers of our civilization—the ancient Greeks—we do not appear to have improved so far as our bodily structure is concerned, nor assuredly so far as some of our mental capacities are concerned.... Does the reason of the average man of civilized Europe stand out clearly as an evidence of progress when compared with that of the men of bygone ages? Are all the inventions and figments of human superstition and folly, the self-inflicted torturing of mind, the reiterated substitution of wrong for right, and of falsehood for truth, which disfigure our modern civilisation—are these evidences of progress? In such respects we have at least reason to fear that we may be degenerate. Possibly we are all drifting, tending to the condition of intellectual Barnacles or Ascidians.

Like these creatures, whose juvenile forms show evidence of a higher life, “It is possible for us—just as the Ascidian throws away its tail and its eye and sinks into a quiescent state of inferiority—to reject the good gift of reason with which every child is born, and to degenerate into a contented life of material enjoyment accompanied by ignorance and superstition” (59–61).

Lankester’s marshalling of morphology and embryology to demonstrate degenerative evolution complemented the alarms raised by other students of the contemporary condition. The physician Bénédict-Augustin Morel had sounded the alarm in 1857 on the deleterious effects, physical and otherwise, of modern habits and conditions of life, and the criminologist and physician Cesare Lombroso had argued the visible stigmata of criminality as a form of evolutionary atavism.<sup>57</sup> An anticipation by more than half a century of Lankester’s dietary conjectures (in satirical dress) appeared in Thomas Love Peacock’s *Headlong Hall* (1816). Mr. Escot, the “deteriorationist,” dates the degenerative turn from the invention of fire and the perversion of animal flesh into food. “From that period the stature of mankind has been in a state of gradual diminution, and I have not the least doubt it will continue to grow small by degrees and lamentably less, till the whole race will vanish imperceptibly from the face of the earth.”<sup>58</sup>

In 1884–1885, at the new science school in South Kensington, the young H. G. Wells studied under Huxley, whom he admired profoundly and whose work he followed closely, and he would have known Lankester and his work as well.<sup>59</sup> Some of what Huxley distilled into “The Struggle for Existence” (which ends in a brief for science education) left its mark in the extrapolated futures of Wells’s early science fiction. It is evident in that archetype of the genre, *The Time Machine*, whose first form, “The Chronic Argonauts,” appeared in the *Science Schools Journal* in 1888. Though Wells developed his story with the antiutopian, anti-Spencerian notion in mind that degeneration came in the wake of a stable equilibrium and through the absence of any challenging selective pressures, in the final version (1895) the degenerate and differentiated races of childlike Eloi and predatory Morlocks are evolutionary adaptations to conditions reflecting the radical division in class and culture and the notable difference in selective pressures pervading present-day industrial society. The ruined vestiges of a perfected high civilization, with its grim underworld, is a degenerative regression of both high culture and industrial society to a perverse avatar, a parodic form of pastoral idyll and pastoral economy. With the Eloi, parasitism, idleness, and torpidity have done their work, as has immiseration in the case of the Morlocks. The childlike character of the Eloi suggests a degeneration marked by arrested development; the nocturnal, subterranean, predatory character of the Morlocks, a degeneration by way of deprivation, habituation, and disuse. Degeneration of the social order and of the biological organism have gone hand in hand, as, in Huxley’s phrase, “animal man...resumes his ancient sovereignty.”<sup>60</sup>

And the cosmological background is not far behind. As the time traveler escapes the carnivorous Morlocks, he inadvertently plunges far into the future and, in the most remarkable and poetically charged portion of the book, reports the progressive changes. Traveling in place at prodigious speed, he describes how the “palpitating greyness” grew darker, and the “the blinking succession of day and night,” ordinarily indicative of a slower pace, reappeared, grew slower still, as did the track of the sun across the sky, until the sun, growing broader and more red, ceased to set, and the moon vanished entirely. The report is phenomenological or, rather, observational; the reader is to supply the causation: the sun is cooling, the earth’s orbit is decaying, and its rotation is gradually slowing. Finally, with the sun halted motionless upon the horizon, “a vast dome glowing with a dull heat,” the traveler understands that “the work of the tidal drag was done” and that the earth “had come to rest with one face to the sun, even as in our own time the moon faces the earth.” Halting on what appears to be a desolate beach of red rocks and the lichenous vegetation that grows in such a perpetual twilight, the traveler finds himself among “monstrous crab-like creature[s]” along a salt-edged sea without breakers or waves or a breath of wind. “I cannot convey the sense of abominable desolation that hung over the world. The red eastern sky, the northward blackness, the salt Dead Sea, the stony beach crawling with these foul, slow-stirring monsters, the uniform poisonous-looking green of the lichenous plants, the thin air that hurts one’s lungs; all contributed to an appalling effect.” Traveling further, in millennial strides, he watches the sun grow larger and “the life of the old earth ebb away.” He stops finally “more than thirty million years hence” with the red dome of the sun obscuring “nearly a tenth part of the darkling heavens.” The air is bitter cold; there is a

glare of snow and a fringe of ice along the salt ocean, “all bloody under the eternal sunset.” The world is nearly silent, and then a huge eclipse, which the traveler believes to be the transit of an inner planet, turns all but the stars to blackness. The traveler is overcome by a “horror of this great darkness” and the smiting cold. But with the return of the sun, he sees a moving thing, small, round, trailing tentacles, “black against the weltering blood-red water, and...hopping fitfully about,” and full of dread he musters the energy to make the return journey.<sup>61</sup>

As he travels back, the sun gets golden again and the sky blue, and the shadows of houses give “evidences of decadent humanity.” The round, hopping creature of the terminal vision is not further identified, but the giant crabs of the previous stop carry an echo of Wells’s speculations in a contemporary essay on “The Extinction of Man,” where among the potential successors of humanity as dominant species are the crustacea. Wells rubs in the observation that no “really dominant species” is ever succeeded by its own descendants and that humanity’s prospects are those of “every other predominant animal the world has ever seen...the hour of its complete ascendancy has been the eve of its entire overthrow.”<sup>62</sup> Such evolutionary discontinuity is not the message, however, in another essay that looks ahead, written it would appear after *The Time Machine*. In “Of a Book Unwritten,” a professorial figure imagines the result of extrapolated evolutionary tendencies and adaptive pressures, or their lack, on man, including a reduction of the physical, an externalization of digestion, a development confined to heads and hands.

Then the earth is ever radiating away heat into space, the professor reminds us. And so at last comes a vision of earthly cherubim, hopping heads, great unemotional intelligences, and little hearts, fighting together perforce and fiercely against the cold that grips them tighter and tighter. For the world is cooling—slowly and inevitably it grows colder as the years roll by.<sup>63</sup>

In a vision suggestive of E. M. Forster’s “The Machine Stops,” he locates these creatures deep underground in galleries and laboratories equipped with vast metallic shafts and ventilators, while the world above is a waste of snow and ice with “all animals, all vegetation vanished, except this last branch of the tree of life...following the diminishing heat of the planet.” In *The War of the Worlds* (1898), Wells’s Martians are such cerebral creatures, transformed by their huge mechanical carapaces, in effect exoskeletal bodies, into the likeness of giant crustaceans. In the history of the solar system, their planet has traveled farther on the road to terminal exhaustion, and both they and their dying world are the shadows of things to come.

Wells was a catastrophist who tried to be a gradualist and generally failed—as his Fabian history shows—through impatience and a profound loathing for disorder. Catastrophes—apocalyptic wars, cosmic disasters—serve as world-transforming events in many of his future histories, an advantage for dramatic fiction. In some cases they are the necessary prelude to the orderly, even utopian societies that serve to defer the inevitable, incremental decline inscribed in the nature of the physical, a decline that visibly nagged at Wells. But it was the presentness of entropy in the turmoil of industrial civilization, in that civilization’s explosive disorder and unplanned heterogeneity, in its vast pointless expenditures of energy, that so offended Wells and fueled his passion. There is a telling



passage in his apocalyptic novel, *In the Days of the Comet*, with a narrator and protagonist through whom Wells's own sensibility and emotional experience surely speak. Leaving his native valley, he thinks forever, the narrator looks back on "the group of towns that had borne me and dwarfed and crippled and made me."

But it came to me then, I am sure, for the first time how promiscuous, how higgledy-piggledy was the whole of that jumble of mines and homes, collieries and pot-banks, railway yards, canals, schools, forges and blast furnaces, churches, chapels, allotment hovels, a vast irregular agglomeration of ugly smoking accidents in which men lived as happy as frogs in a dustbin. Each thing jostled and damaged the other things about it, each thing ignored the other things about it; the smoke of the furnace defiled the pot-bank clay, the clatter of the railway deafened the worshippers in the church, the public-house thrust corruption at the school doors, the dismal homes squeezed miserably amidst the monstrosities of industrialism, with an effect of groping imbecility. Humanity choked amidst its products, and all its energy went in increasing its disorder, like a blind stricken thing that struggles and sinks in a morass.<sup>64</sup>

In the event, the comet brings about a metanoia, a change of mind in the world (chemically inspired) appropriate to the epigraph from the final choral lyric in Shelley's *Hellas*: "The World's Great Age begins anew." And the world of war mania, economic crisis, industrial violence, wrath, jealousy, and sexual misery, paroxysm and waste, the world where entropy is gaining the upper hand, passes away for now if not forever. At bottom, however, it was consciousness, impassioned human intelligence with its organizing capacity, that could supply a countering tendency to the mindless activity of the elemental world in Wells's cosmos, just as ethical consciousness could inflect the rigors of competition in Huxley's biological world. It is that counterforce that Wells named in 1919 in the title of his post-Armageddon Job story with its updated Faustian prologue in Heaven. When, in *The Undying Fire*, Wells's present-day Job asserts—in the face of all the evidence from nature, collective catastrophe, and personal suffering—"that the creative desire that burns in me is a thing different in its nature from the blind Process of matter, is a force running contrariwise to the power of confusion," he is setting that flame against the prospect of heat death, a terminal cold, a dark and darkening "Nothing," as well as against the mindless suffering and waste of nature's gropings and the perverse application of mankind's competitive evolutionary legacy.<sup>65</sup>

## TRISTES ENTROPICS

The earth mourneth and fadeth away, the world languisheth and fadeth away, the haughty people of the earth do languish.

—Isaiah 24:4

Three versions of nightmare fraught with entropic chaos troubled the spirit in the declining nineteenth and dawning twentieth centuries: ecological, cosmological, and anthropological. The last can stand as a blanket term for society, culture, and human biology in their imagined (often collusive) enervation and undoing. With chaos wed to a time-bound process, narrative afforded the most appropriate vehicle for its representation—imaginative narrative that gave meaning to impersonal forces and tendencies by placing human consciousness in their path. All three dimensions, ecological, cosmological, and

anthropological, could make themselves felt in a single narrative (as they do in Wells's 1895 *Time Machine*), though usually one or another took precedence. Such, for example, is the case with the notably cosmological visions of futurity drawn by the astronomer and science writer Camille Flammarion in his international bestseller *La fin du monde* (1894), whose publication coincided with the gestation of Wells's novel. As the century drew to a close—a century where the visible achievements, institutional prestige, and explanatory power of science gave it unprecedented authority—the moment was surely ripe for the science-conscious fictional genre that now took form. It drew on a science, moreover, that had vivified not just the immensities but the processes articulating time, giving scope for plotting time as an unfolding story and for looking ahead to endings (and perhaps new beginnings) through a lens that gives fantasy the color of reality.

One of the principal fascinations in the imagination of chaos in the nineteenth and early twentieth centuries is the interplay of scientific argument with political and social attitudes and agendas, marked in the persistence of certain thematic rivalries, like those between catastrophic and gradual change, conservation and transformation, progress and decline. There was also a question in science as to whether its writ could run to beginnings and endings, matters beyond what is observable in the world we know. But such methodological challenges in no way affected the possibilities of imaginative projection. And as in the complementarity of energy and entropy, catastrophe and incremental decay could rival and reinforce each other as the path to terminal chaos. Catastrophe, as always, has dramatic appeal. But incremental decay evoked a deeper uneasiness, reinforced at need by observation and analysis. There is a discernible arc through the long nineteenth century, from the rebellious exhilaration that initially found in energetic chaos liberation and release at the expense of petrified order, to the depressive anxiety that in the final decades afflicted numerous thinkers, critics, and imaginative writers. These—in spite of the religion of progress and the unprecedented transformations in daily life wrought by the harnessing and deployment of energy—saw in present circumstances signs of the inexorable advance of universal decay. In the early twentieth century, the conflicted historian Henry Adams, seeking to take the measure of his own belatedness, would in his *Education* and elsewhere travel the full distance between those extremes, as a living illustration of the dissonance between the century's celebration of energy and a darkening awareness of entropy's enlarging domain.<sup>66</sup> But there were significant earlier attempts to grapple with entropic decay imaginatively, culminating (in the account that follows) in the panoramic epic of a historian of a different kind than Adams, also with scientific leanings, namely Émile Zola, anatomizing in his fictional post mortem an entire nation's progressive descent into chaotic, catastrophic dissolution.

## NATURE DECAY'D

One should be mindful that when Wells's *Time Machine* and Flammarion's *La fin du monde* appeared, the genre label "science fiction" had yet to take hold. Flammarion's fiction of the future appeared in his publisher's lists among his "Ouvrages philosophiques."<sup>67</sup> As such,

Flammarion's novel also harks back consciously to an end-of-the-world fantasy from the beginning of the century, one that patently struck a chord with the English Romantics and—although indebted less to science than to political economy for inspiration—one that incorporated the elements of an ecological and anthropological undoing with an apocalyptically catastrophic conclusion. Cousin de Grainville's *Le dernier homme* (1804), brought into English as *The Last Man*, or *Omegarus and Syderia*, a *Romance of Futurity* (1806), is perhaps most interesting today for its anticipations of ecological nightmare. Flammarion, while pursuing a wider cosmic agenda, pays tribute to this precursor by similarly naming his own terminal protagonist Omégar.

Neither universal cataclysm nor secular decay were novel tropes at the beginning of the nineteenth century or in the world's historical imagination. But the common classical narrative of nature in decline from an earlier golden age laid out a rather different trajectory. It told of a descent into a less genial, more brutal state, where nature gone wild was inimical and powerful. Progress meant taming its excessive and dangerous forces, turning the wilderness into a pleasing, useful, cultivated prospect. Even within the aura of the Romantic exaltation of nature's overwhelming energies, the ambitious projects of drainage and cultivation launched by Goethe's *Faust* were by no means the devil's work, however little they satisfied the insatiable Faustian soul. But as the nineteenth century progressed, intimations of a nature with intrinsic limits, not a vast reservoir of energy and unplumbed resources but a finite store subject to nonrenewable depletion, vulnerable to abuse as well as to time, percolated up through the expansive heroics of exploration and exploitation and emerged amid alarms in the anxieties of the century's close. In Flammarion's future, human interventions in the processes of nature still count heavily on the positive side of the ledger, deferring the inevitable conclusion through compensatory schemes and technical bravura. With the second law brewing in the wings, however, the interactions of man and nature—as in Wells's industrial wasteland or in the much-noted contraction of the European forests—could take on the lineaments of a looming ecological nightmare. If the entropic claims on the physical base that supports all biological life are seen as finally nonnegotiable, the visible disintegrative effects of human agency on the environment could not easily be written off through a faith in endless progress or a tendency to benign equilibration. Nor could the arresting fact of the swift extinctions and near extinctions in North America and the South Seas be all that comfortably explained—the passenger pigeon, the great herds of bison, the unfortunate dodo—as falling under the wise dispensation of the law of the survival of the fittest. While such matters of fact and experience played a part in stimulating the nightmare of an exhausted and dysfunctional nature, so would that great achievement of nineteenth-century science, its provision of a comprehensive understanding of the workings of energy systems, not excluding the terrestrial energy economy. Yet until late in the century, according to some commentators, that knowledge worked more harm than good because it was so selectively biased in popular understanding.

Before systematic energy theory had had a chance to undermine the faith in endless progress, however, or in a universal evolutionary principle (indeed, before these progressive ideas had won out over steady-state Newtonian models for matters remote from celestial mechanics), another construct, this time from political economy, supplied a framework of

limitations that prepared the way for the specter of ecologic entropy. Malthus's deeply conservative *Essay on the Principle of Population* came out of the Newtonian century in articulating a system whose forces—human reproductive pressure and a lagging food supply—would tend toward a fluctuating equilibrium through the workings of “positive” and “preventive” checks. On reflection, the pressure driving the system might force itself into more dynamic outlets: outward, into colonial expansion, for instance, or upward, through selective winnowing, into forms of improvement. Neither counts for much in Malthus's original treatise (1798), but more than half a century later Darwin starts from Malthus's pressure of population upon available resources, with its effects on organic life played out and inscribed in the vast chronological vista to be found in the geology of Lyell.

However, another form of directionality cognizable in the *Essay* was the effect of the pressure on place. Where there is a finite supply of arable land, as in an island, a delimited countryside, a national territory, or the earth as a whole, the disparity between the tendency to geometric population increase and at best arithmetic increases in the food supply (the mathematics that brought Malthus his fame) would be worsened as less and less fertile land is bought into cultivation and as formerly productive soil gets worn out. Such fatigue in the earth as a whole, more particularly the depletion of its fertility, forms the burden of the nearly contemporary philosophical novel of Jean-Baptiste Cousin de Grainville *Le dernier homme* (1804), which the great historian Jules Michelet saw as the imaginative counterpart of “another poem, no less fictive, but in an abstract and serious form,” namely Malthus's treatise on population.<sup>68</sup> As such, *Le dernier homme* could point the way for Flammarion's *Fin du monde*, and earlier, probably in its anonymous English translation, it found a responsive readership in the circle of Byron and Shelley.

The story, a magic-mirror revelation of futurity, is offered to Grainville's narrator, in Syria with Bonaparte's army, to honor the moral heroism of the Last Man on Earth in the only way possible: by revealing it to his progenitors. For him, uniquely, only the past can serve as posterity. In the first part of an intricate nest of narratives, aboriginal Adam, returning to the earth to save his remote descendant from a fatal mistake like his own, seeks out Omegarus and Syderia in their bower, where Omegarus willingly brings him up to date. Omegarus does so—recalling the first couple's entertainment of Raphael in *Paradise Lost*—by narrating his own experiences and repeating the historical narratives of various sage informants. It is Adam, however, who is best equipped to perceive the fallen state of the earth in these, its last days:

The sun had just then commenced its career. With what astonishment did the Father of Mankind behold the plains and the mountains stripped of verdure, dry and barren like a rock; the trees in decay, and covered with a whitish bark; the sun, whose fire was grown dim, casting on every object a livid and gloomy light. It was not the hoary frost of winter which shed this horror on nature. She preserved, even during the hard season, a beauty, a vigour, which promised an early fecundity; but the earth had undergone the common destiny. After having for ages struggled against the efforts of time and men, who had exhausted it, she bore the melancholy features of decay.<sup>69</sup>

Beholding with grief “this decay of the universe,” Adam learns that some twenty years before Omegarus's birth wedlock also had ceased to be fertile.

The inset discourses, now retold, speak of a great past where humanity, transcending the destructive plague of “maxims” and inspired to heroic labors by a great natural



philosopher achieves the perfection of the arts and virtues. But in time, “the earth, having attained that high degree of glory and happiness, experienced the fate of men, who, when they have reached the perfection of body and mind, lose the fire that animated them, and soon encounter the decay of old age and death” (1:100). As the earth loses its fecundity, humanity turns to a Virgin Lands solution—first the riverbeds, then the ocean floor—to ward off the impending horrors. Then human fertility collapses, and the project is abandoned, since now, “We have no posterity” (1:119). Moreover, the sun shows signs of decay, turning pale and cool, and the northern territories of the earth are abandoned.

The inhabitants of the ancient world, after having exhausted their soil, inundated America like torrents, cut down forests coeval with the creation, cultivated the mountains to their very summits, and even exhausted that happy soil.—Then they descended to the shores of the ocean, where fishing, that last resource of man, promised them an easy and abundant supply of sustenance; hence, from Mexico to Paraguay, the shores of the Atlantic ocean and South seas are lined with cities, inhabited by the last remains of the human race.

(1:141)

The plot that carries the novel to its apocalyptic ending emanates from the earth’s “Genius,” a spirit whose element is fire, conniving to evade the doom that links the planet’s fate (his own) to human fertility. His one chance lies in promoting the union of Omegarus with Syderia, the daughter of a hardy remnant of forest dwellers. But then, afforded a vision of a bestial, degenerate descent, Omegarus rejects his role as the new Adam and (with anguish) abandons the pregnant Syderia, which will mean her death and that of the child. With that fatal decision, the End begins, with effects catastrophic and apocalyptic, physical and metaphysical. The last wanderings of Omegarus and the hapless Syderia give place to the last desperate efforts of the Genius of the Earth to defer the end, working in laboratories at the center of the earth to repel “the deadly cold that was daily penetrating more and more towards the center of the universe” (2:163). With the sun now nearly extinguished, the Genius persuades Death, temporarily, to withhold his stroke. But when at last Death touches Syderia (before an assembled gallery of celestial and infernal powers and the shades of the dead), joy breaks forth, time ends, Hell shrieks, the sun and stars go out, and “the gloomy night of chaos enveloped the world” (2:197). Fleeing Death, the Genius of the Earth blows it up for a spectacular finale, putting a torch to the magazines of sulfur, bitumen, and other volatile substances in the deepest caverns, “and the tremendous explosion hurld the convulsed earth back upon her orbit! Her bowels were torn to the centre; the Alps, the Pyrenees, the Andes, were detached, and with irresistible undulations whirled to the upper regions of the atmosphere” (2:203).

To end with a bang serves a good literary purpose, but it was perhaps even more effective in a Europe conscious of having recently experienced an earth-shattering explosion and whirlwind at first hand.<sup>70</sup> Grainville’s *End of the World* was a foretaste of the now better-known “School of Catastrophe,” whose fascination was with convulsive energy. But, probably with Buffon’s *Epochs of Nature* in the background as well as the spirit of Malthus, Grainville had also projected a world of limited and failing productivity where human agency and effort, vividly and elaborately chronicled, served both to hasten and to retard its terminal exhaustion and dissolution. Flammariion, at the other end of the century, found reason in the science and the heartburn of his own time to reverse Grainville’s order and

make the catastrophe a prelude to the terminal entropic decline.

Translated into English (with alterations) as *Omega: The Last Days of the World*,<sup>71</sup> Flammarion's novel also manages ingeniously to incorporate both catastrophist and gradualist scenarios, first the fatal threat of terrestrial shipwreck through cometary collision and then the drawn-out pangs of inevitable entropic decay. Like Wells, Flammarion divides his romance of futurity into the proximate and the remote. Part 1, in the twenty-fifth century, contemplates the end of the world as a catastrophic event, culminating in the Day of the Comet; part 2, "In Ten Million Years," takes us—in Shaw's title phrase for the final play of his Methuselah cycle—"As Far as Thought Can Reach," to the end of the earth's habitability and beyond.

The first and longer part depicts an extrapolated world only half a millennium on, with numerous technological and political developments. Flying machines abound; the center of civilization is now Chicago (a future inspired perhaps by the World's Columbian Exposition of 1893). But the principal interest is in the public and institutional response (journalistic, artistic, scientific) to what the first chapter names "The Celestial Menace." As the comet makes its spectacular approach, the narrative finds place for a good deal of instructive commentary, serving an appetite for fact as the ground of fantasy and putting cosmic anxiety on a solid ground of scientific explanation.

The chief narrative device for exploring all aspects of the threatened end of the world is a convocation of scientists at the august Institute of France a few days before the now inevitable collision. Here, in the eye of all humanity, the participants from an array of disciplines attempt to evaluate the celestial menace from their various scientific perspectives. The first to declare himself is the director of the Paris Observatory, who acknowledges the immanence of some sort of partial catastrophe but pronounces authoritatively, "Worlds die of old age and not by accident."<sup>72</sup> The debate having been framed as between entropic gradualism and a catastrophic singularity, the president of the Academy of Medicine argues, from the comet's composition and size, the prospect of universal extinction on physiological grounds, through oxygen deprivation and carbon-monoxide poisoning. The president of the Astronomical Society, however, though expecting more atmospheric fireworks than impact, locates the chief danger in the conversion of the comet's motion into heat; the secretary of the Academy offers a scenario wherein the atmosphere itself would take fire and the shock touch off a firestorm over the face of the earth. Alternatively, a skeptical surgeon, citing spectroscopic observations, suggests the possibility of universal anesthesia via nitrous oxide or else universal exaltation in an oxygen high—"Everyone would burst out laughing"—a speculation Wells would turn utopian in his own subsequent novel *In the Days of the Comet*.

After a recess, a leading geologist rejects such catastrophist scenarios on general grounds and instead envisages the wearing away of the land by wind and water over millions of years, with gravity effecting "the complete leveling [aplanissement]" of the continents (91) and finally the wholesale disappearance of dry land under the silted-up seas. The chief meteorologist, however, immediately proposes an opposite scenario, equally entropic and equally fatal in the end. Supported by terrestrial records and lunar and Martian evidence, he projects a gradual dehydration culminating in death by drought.

Through the formation of hydrates, absorption in the earth's interior brought on by secular cooling, and other processes, water would gradually disappear (slowing erosion). Plant and animal species would alter but then also gradually disappear, until in the end "the human species itself, in spite of its adaptive transformations, dies of hunger and thirst on the bosom of the desiccated Earth." Carrying this scenario a step further, the brilliant young woman whose computations had first raised the alarm about the comet's trajectory argues that humanity will in fact die of the cold, as the earth loses its envelope of water vapor and the atmosphere thins. "The principles of thermodynamics show that the temperature of space is 273 degrees below zero. There, gentlemen, is the more than glacial cold in whose midst our planet will sleep when deprived of the atmospheric veil that now so warmly wraps it in its protective duvet." An academician then brings all back to the sun itself, whose energy drives all life and activity on earth but which nevertheless must eventually run down, lose its heat, form a crust, and darken. In the end, "the frozen cemetery that is the Earth will continue to circle the black Sun and to drift in the infinite night, carried along with the whole solar system into the vast abyss. It is the extinction of the Sun that will have brought about the death of the Earth—in twenty million years or so, or even longer" (123). Other possibilities are advanced—the sudden arrest of the earth in a stellar electrodynamic field, or the sun flaring up into a nova—before the director of the Observatory sums up, adding generously to the list of mortal perils, but agreeing finally that terrestrial extinction will forestall the death of the sun and will come about gradually, as the earth loses its protective envelope of atmospheric vapor and, in the inexorable advance of the drought and the cold, falls toward the temperature of space.

Before adjournment, a decoded pictographic message from Mars pinpoints the site of impact (Rome) and recommends flight. There is a vivid account of "Le Choc," of the terrifying passage of the earth through the coma of the immense visitor with its nucleus of gases, particles, and bolides, one of which strikes near Rome and is reported (erroneously) to have wiped out the papacy and the whole College of Cardinals. In the event, there is considerable physical destruction from the bombardment, the heat, and the fires: several hundred thousand deaths in Paris alone, the majority, however, from the effects of anxiety and panic. The earth and humanity emerge more or less intact, and Flammarion concludes that the earth will continue to turn in the fecundating light of the sun, and humanity will continue its upward course. As for the comet, "it had been above all the excuse for a discussion from every possible angle of this vast and momentous subject of THE END OF THE WORLD" (226).

The second part of the work begins with a conspectus of the evolutionary stages, social and ultimately physical, from about the year 3000 to 20,000. Wars come to an end (through a Women's Strike for Peace), one language becomes universal (a modified Anglo-French), and there is much technological development in transportation (aerial) and communication (telephonoscopy), much urban development, and the end of the bureaucratic state. Forests disappear, but food is refined and then synthesized directly, eliminating brute ingestion and the deleterious effects of animal eating. The result, after sixty centuries, is a refined and altered human anatomy and a much developed nervous system, though marriage preferences have perpetuated the classic forms of beauty. By about the 200th century,

"The human species ceased to resemble the apes physically, and the carnivorous animals morally" (256). A second chapter, "Les metamorphoses," takes a wider and longer view of the earth's physical geography and demography, including an influx of new peoples to Europe and the washing away of its western coasts and lowlands. With time, "the domain of nature had steadily retreated before the victories of civilization. The entire planet had ended by becoming the garden of humanity, garden thereafter managed scientifically, intelligently, and rationally" (272). In these chapters, Flammarion confesses a faith in progress that transcends physical and biological circumstance. As he writes it, "Progress, supreme law, had conquered the world in spite of the checks, the obstacles, the stumbling blocks men continually set in the way of its march; and humanity had slowly increased in knowledge and in happiness through a thousand transitory fluctuations, to arrive at its apogee and travel the path of terrestrial destiny" (230).

"The Apogee" describes a much refined and spiritualized humanity, one that has developed entirely new senses and is socially, physically, erotically, and intellectually evolved almost beyond imagining. (In this richly illustrated book, Flammarion apologizes for his artists' need to work with images one can recognize.) "But the time came when, with the conditions of terrestrial life starting to decline [*decroître*], humanity itself was bound to cease its progress, and enter on the path of decadence" (292). The internal heat of the planet had long been dissipated, loss of an energy resource that did not, however, much affect surface temperatures. But the surface of the earth was indeed being leveled, however insensibly, and the globe, aging faster than the sun, had lost many of those conditions that favor vitality. Having escaped the snares and accidents of life in the cosmic immensity, "Old age lay in wait for it too, as for all other beings" (295). Most debilitating is the ever-increasing desiccation. Martian conditions had coincided with our apogee, Mars itself by then having reached its terminus and ceased to communicate. As the waters diminish and the cold increases, humanity withdraws to narrow equatorial regions. The surviving plants and animals adapt and the human population wanes to several hundred thousand, living in groups, sustained through ingenuity and artifice, in greenhouse architecture—anticipatory artificial Biospheres. Ten million years out, the sun's light and heat are reduced by no more than a fraction, but the rotation of the now nearly featureless earth is much slowed, and the day is 110 hours long.

Flammarion discerns the shape of a parabola in the course of human (and planetary) history, a *courbe géométrique* that starts from zero, the primitive cosmic nebula, and having attained its "luminous apex," descends as it rose, "to fall into eternal night" (298–299). In the last stage of humanity, Omégar and Eva, the only surviving representatives of the two remaining civilized groups, find each other (telepathically) and proceed, with the help of some terminal mysticism, to their earthly consummation and spiritual translation—to Jupiter, that immense new world now in its ascent and ready to receive "the heritage of terrestrial progress" (356). But before that transmigration, having been revitalized by love, they make a life together, Omégar maintaining the essential machines with the help of some wandering savages, a spectral remnant of that portion of the human stock that, before succumbing, had fragmented, regressed, and degenerated toward the primitive and the simian. "The ancient law of progress had given way to a sort of decadence, matter had reclaimed its



rights, and man returned to animality” (343). In their double solitude, Eva and Omégar philosophize on the obscure meaning of it all until, one day, “However marvelous it was, the system stops” (350). The remaining underground waters have entirely ceased their flow in the frozen earth. Seeking a possible oasis, they survey the dead planet, a graveyard of sterile ruins, from a flying machine that comes to rest in ancient Egypt, where they meet their deaths and (under the guidance of a pharaonic specter) illumination and translation. On the earth, a few wretched and primitive human groups briefly remain, some degenerate animal species survive a few thousand years longer, but finally, gradually, “all terrestrial life is extinguished” (360).

Flammarion supplies an epilogue to the end of the world, a final “Dissertation philosophique” where he sketches the possible posthumous history of an earth that, though “dead and frozen...still carries in its bosom an energy—not lost—of translation, its movement around the sun” (368). He sees the sun itself, after twenty or thirty million years, as a cooling mass, producing its own life forms radically different from those that had flourished successively on the dead planets. Then, eventually, the sun also goes out, as do the visible stars. But the universe continues to exist, Flammarion insists, as at present. For supposing a universe infinite in extent and duration, he refuses to admit a thermodynamic terminus, let alone a beginning, nor will he abandon the idea of progress. For one thing, collisions (as of our dead sun with another burnt-out star) can always provide new local beginnings, and for another, “the apparent universe, the visible world, is the crucible wherein the spiritual universe ceaselessly develops [s’élabore]” (383). In a tailpiece illustration, a sphinx with its paw on a skull sits on a pedestal on which there is written—somewhat contradictorily—“ $\alpha = \omega$ .”<sup>73</sup>

As one might expect, Flammarion’s philoscientific novel is threaded with the issues and concerns of his own day, from the political struggles between the church and liberal secularism over education and public morality, to the strain on natural resources, notably wood and water. Anxieties about the failure of the most cultivated to reproduce and ambivalence about sexual liberation and gender difference show themselves even in the delineation of the social and sensory erotic paradise humanity achieves at its apogee. The sublime consolations of love and the assurance of an unending spiritual progress strive valiantly to neutralize the intrinsic melancholy of a secular, material order subject to meaningless accident and destined in any case to an inexorable decline into a cold, lifeless, featureless nullity. But it is the sentimentality of these sublime consolations and of the evasive final death and transmigration in the shelter of a precocious New Age cosmic spiritualism, that distinguishes Flammarion’s end of the world from Wells’s unsentimental, chilling vision of decadence and ultimate heat death in his canonical *Time Machine*. And equally unsentimental, in another vein entirely, would be the almost casual assimilation of ecological decline to present-day social arrangements and personal lives in the work of a far greater turn-of-the-century imaginative writer, Anton Chekhov.

When ecologic concerns resurfaced toward the end of the nineteenth century, it was in the context of a world altered by industrialism and conscious of dynamic physical change, ordinarily filed under "Progress." But for an informed critical eye, there was much in the industrial landscape, the social fabric, public health and private neuroses, rural decline and urban pathologies, that suggested a trajectory of degradation and debility. Resources, natural and human, stores of potential, could be wasted irretrievably. Not that contemporaries living unexceptional lives were likely to be inordinately preoccupied with such matters or adopt very coherent views beyond the generalization that things are going to the dogs. Accordingly, the literature concerned with representing those lives as lived would be obliged to rely on indirection and imputation if at the same time it wished to represent an ambient entropic reality. Something of the kind shows up as a subordinate strain in the art of one of the subtlest delineators of the entropic condition in contemporary lives and their collocations, Anton Chekhov, for whom, as it happens, insights drawn from the natural sciences were important.<sup>74</sup> Refractions, ecological and physical, appear in the major plays, with their evocation of a climate of stagnation in a social and dramatic world where the cumulative losses, brave or foolish resistances, steady erosion that levels and coarsens, culminate in terminal dissolution. Chekhov is everywhere alive to ambiguities, so that, in *The Cherry Orchard*, the irretrievable loss of the moribund estate and its glorious orchard to make way for summer bungalows is also a release of entrepreneurial energy in the conflicted Lopakhin, son of a serf, and there is energy wherever work, however purposeless, takes the place of cultivated wheel spinning, or even where brute reproductive capacity dispossesses mind and sensibility, as in the marooned genteel world of *The Three Sisters*. But where such energy breaks in or breaks out, it is usually at the expense of quality or cohesion and in the end proves dissipative. It is true that some of the most attractive of Chekhov's characters look forward to a better world in some hundreds of years, helped by present efforts to stay or reverse entropy. But generally such views are ironized by inertia or untoward events while the very dramaturgy of the plays, their affective shape, subsumes all in the entropic flow.

The ecological dimension surfaces in Chekhov in the 1890s, memorably in the figure of Astrof in *Uncle Vanya* (ca. 1896), a transformation of Chekhov's earlier *Wood Demon* (1889). A much overworked country doctor, driven to drink and cynicism but who nevertheless plants trees and saves woodland, Astrof brings to the play his obsession with the decline of the forests and its effects on climate and temperament, a decline made visible as a three-stage time series on a color-coded map he is making of the district. The wood of the forests, sold off by those who "don't create anything, but merely destroy what has been given them from above," is consumed wastefully and unnecessarily even where peat is abundant for burning and stone for building. His map is "an unmistakable picture of gradual decay," which will be complete in fifteen years, not as the price of civilization or industry, for nothing comes to replace the forests, while the same mosquito-laden swamps, dire poverty, and rampant disease remain. Astrof's map shows former settlements, animal populations both wild and domestic, plant life, water mills, and their disappearance. "Here we have a picture of decay due to an insupportable struggle for existence, it is decay caused by inertia, by ignorance, by utter irresponsibility."<sup>75</sup>

Concern over the depletion of the forests and the degradation of resources had in fact claimed serious official attention in Chekhov's Russia.<sup>76</sup> Connecting the waste of nature to the waste of life in the generation after the great emancipation was a more complicated and delicate matter. In *Uncle Vanya*'s more hopeful precursor, Elena says, "The forests are being saved by the Wood Demon [the Astrof figure], but there's no one to save the human beings."<sup>77</sup> Yet the forests are not being saved, as the district map shows. And even though Astrof uses a Darwinian phrase—the struggle for existence—to characterize the driving force in the impoverishment of the environment, he does not thereby exculpate people or society on the grounds of scientific inevitability. When Chekhov admits the gravitational pull of natural law and the general drift to his representations of how it is, it is to plot their intersection with human agency and human passivity—with the possibility of it having been otherwise.

The general thermodynamic drift toward universal heat death enters Chekhov's work with *The Seagull* (1896), in the form of Trepliov's play within the play. The latter, written and staged in the style of contemporary symbolism, is the *al fresco* creation, unintentionally parodic, that furnishes the business of the opening episode. Trepliov's mother, the actress Arkadina, dismisses it as belonging to "the Decadent School." Trepliov introduces it as a dream of how things will be in two hundred thousand years, and Sorin, his uncle, interjects that in two hundred thousand years "there will be just nothing." Trepliov counters, "Well then, let them show us that nothing!" Largely consisting of a monologue spoken by Nina as the collective soul of all that has lived, the play describes, in negatives, an earth that has been barren of all creatures for millennia: "cold, cold, cold," and "deserted, deserted, deserted." What remains (belonging to the Father of Eternal Matter, the Devil) is "a perpetual flux of atoms"—and the abiding spirit.<sup>78</sup>

Trepliov's symbolist play should not be overburdened with meaning (though Nina's second recital of her monologue, recalled after she has experienced suffering and loss in the real world, is a moment of transcendent effect). Nevertheless, its "nothing" strikes a note that qualifies the emotional turmoil of the circle orbiting Arkadina and inflects the ambiguous symbolic uses attached to the dead seagull in the surrounding play. The reasonless killing and pathetic remains of the seagull are unreliably appropriated for attachment to human subjects and relations by Chekhov's characters. Made weighty in the title, it stands as an unedifying example of human symbol making. The gratuitous slaughter remains a mindless act impoverishing the natural world, and it links two dimensions of reckless waste and casual cruelty: toward nature and between persons, which then become part of the tide of time and loss.

Shortly before *The Seagull* and his return to the material of *The Wood Demon* in *Uncle Vanya*, Chekhov found a way to strike the ecological note as the concrete expression of pervasive entropy, universalized and privatized in the inwardness of subjective experience. His masterful story "Rothschild's Fiddle" (1894) makes the center of consciousness one Yakov Ivanov, village coffin maker and occasional musician, but not a man of enlarged sympathies or much given to reflection.<sup>79</sup> The story, however, tells of his awakening to the waste of his life after his wife dies—whom he never thought about or gave affection to—while he himself is sickening of the same fever. Yakov's one eccentricity, compounding his

usual surliness, has been his curious habit of keeping accounts that register his “losses”—how much he might have earned, for example, if it were permissible to work on Sundays and feast days or if a sickly townsman hadn’t moved out of the district to die elsewhere—and it is this mode of reckoning that he transfers to a perception of the larger scene and scheme. Visiting the river for the first time in decades, he misses a large birch wood where there is now just a swampy meadow, an old pine forest that is now a bare hillside, and the busy traffic on the river that is now “all smooth and unruffled” and where even the geese are fewer than of old. He reflects on all the things he might have done with the river and the geese and all that he has done to wound and hinder others from living. “Ah! What losses!... life had passed uselessly without any pleasure, had been wasted for nothing, not even a pinch of snuff; there was nothing left in front, and if one looked back—there was nothing there but losses, and such terrible ones, it made one cold all over” (248–249).

Yakov’s practice of calculating his hypothetical losses and giving their sum positive value shares the curious, counterintuitive reversal in the quantification of entropy and informs the eccentric and poignant quality of his musings. As he returns from a visit to the useless hospital,

he reflected that death would be nothing but a benefit; he would not have to eat or drink, or pay taxes or offend people, and, as a man lies in his grave not for one year but for hundreds and thousands, if one reckoned it up the gain would be enormous. A man’s life meant loss: death meant gain. This reflection was, of course, a just one, but yet it was bitter and mortifying; why was the order of the world so strange, that life, which is given to man only once, passes away without benefit?

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He is not sorry to die, but the thought of leaving his fiddle gives him a pang—“the same thing would happen to it as to the little birch copse and the pine forest. Everything in this world was wasted, and would be wasted!” He puts all this feeling into something he plays, which reaches the soul of the Jew, Rothschild, now reluctantly present, whom he had previously terrorized. And so, in a final act of contrition, he leaves Rothschild the fiddle and, as it turns out, the tune.

Chekhov was not likely to take up an overtly aestheticist position that finds the only justification of life in art. But Yakov’s creation, like his gesture of contrition, distilling the awareness of all that waste, all those losses, into a tune, is a piece of negentropy, ordering and concentrating in a transmissible form his perception of the chaotic and the meaningless. The tune gives expression to a specifically human consciousness of the irretrievable in the waste of time, the conjunction that constitutes the tragic sense in its modern guise. Like the story that contains it, it does not assert a foundation of order sustained in and through the appearance of chaos, on the model of Sophocles’ Oedipus. Rather, it acknowledges the absence of such supports and the value of being able to confront and articulate, by any available means, what is missing, what is lost.

## ENTARTUNG

If language is not the only determinant of thought and opinion, its responsibilities in that



department are nevertheless grave. Consequently, as we shall see, at least one militant scientist, alarmed at the complacent recklessness toward the environment encouraged by the first law's widely disseminated formulation as "the conservation of energy," argued for a more graphically descriptive phrase for the second law than the bland term "entropy," or "transformation of energy." The substitution urged by Bernard Brunhes, "the degradation of energy," would have found lexical, cognitive, and affective support in a flourishing vocabulary for cultural, social, and anthropometric phenomena in the expanded turn of the century, in such freighted catchwords as "dissolution," "decadence," and "degeneration." "Decadence" and "degeneration" pervaded the discourse on culture and society. Absorbing the downside in evolutionary thinking, "degeneration" raised alarms through Galton's eugenics, race theory, statistical comparisons, psychopathology, and the various sciences and pseudosciences engaged in the measurement of man. As in the English title of Max Nordau's famous *Entartung* (1892), "Degeneration" also served an attempt to show the debility in contemporary art and culture that was the price of the conditions of modern life.<sup>80</sup> "Dissolution," a less colorful term than the other two, appeared in the title of André Lalande's challenge to Herbert Spencer, *La dissolution opposée à l'évolution dans les sciences physiques et morales* (1899), a book that anticipates Brunhes in some respects and that had an influence on Henry Adams.<sup>81</sup> Fixing on Spencer's definition of evolution as a process of differentiation and individuation, Lalande raises the banner of an opposite, assimilative tendency, one that reduces difference (and competitive individualism) and counters the promotion of social organizations whose members function as highly specialized cogs, individuated but not individual. Drawing his counterprinciple from thermodynamics and in particular the second law, Lalande goes T. H. Huxley one better by asserting the impossibility, for the man who truly thinks, of following the raw evolutionary bent in his nature. That leaves the tendency to dissolution as the only possible grounding for the principle of right action (*bien agir*), "since these are the two great tendencies of the universe in general, and of man in particular. The governing principle of intelligent conduct is thus the voluntary renunciation by each of individuation and differentiation," that is, of the evolutionary imperatives of a competitive self-regard and of seeking advantage at the expense of your neighbor. At root, "the spirit of dissolution is identical with the general spirit of those acts that mankind ordinarily calls moral."<sup>82</sup> As with "decadence" in literature and art—which had its cheeky advocates—there was a contrarian's case to be made in social thought for the positive value of entropy.

Degeneracy, decadence, degradation, dissipation: these attributes of society and humanity in what I called the anthropological nightmare characteristically loomed larger in the critical discourse of the era than in the imaginative work it so often excoriated as the prime symptom, if not principal instigator, of civilization's wasting disease. Even so sympathetic and sophisticated a critic as Arthur Symons wrote, of the "most representative literature of the day":

After a fashion it is no doubt a decadence; it has all the qualities that mark the end of great periods, the qualities that we find in the Greek, the Latin decadence: an intense self-consciousness, a restless curiosity in research, an over-subtilizing refinement upon refinement, a spiritual and moral perversity. If what we call the classic is indeed the supreme art—those qualities of perfect simplicity, perfect sanity, perfect proportion, the supreme qualities—then this representative literature of to-day, interesting, beautiful, novel as it is, is really a new and beautiful and interesting disease.

Marvelous as he finds many aspects of this literature—the attempts at truth to sense (Impressionism) and to spirit (Symbolism), the “revolt from the ready-made of language,” the deliberate aim “to do something new”—he also sees in the courting of decay and neurosis, in “this unreason of the soul,” still another manifestation “of the *maladie fin de siècle*. For its very disease of form, this literature is certainly typical of a civilization grown over-luxurious, over-inquiring, too languid for the relief of action, too uncertain for any emphasis in opinion or in conduct.”<sup>83</sup>

For Max Nordau, who found the evidence of psychophysiological disease everywhere in the art of the *fin de siècle*, the escapist and delusional productions he labels “Mysticism” (Pre-Raphaelitism, Symbolism, “Tolstoism,” Wagner) and the solipsistic impositions he declares “Ego-Mania” (Gautier, Baudelaire, Huysmans, Wilde, Nietzsche, but also—curiously—Ibsen) have their complement in the “false Realism” he especially identifies with Zola. Zola’s Naturalism he strips of its scientific pretensions and labels “the premeditated worship of pessimism and obscenity.” He finds in Zola the stigmata of a “high-class degenerate,” a “sexual psychopath” whose method is obsessional in a psychiatric sense, including an “unhealthy predominance of the sensations of smell.” He sees the constitutional pessimism that in other artists and thinkers inspires the rejection of the real world here inspiring its one-sided calumny.<sup>84</sup>

## ZOLA’S FEVERS

Often under attack for both encouraging and exemplifying the degeneracy in modern life and culture (and like Nordau himself, suffering confusion with his subject), Zola does in fact offer an ambitious representation of society’s entropic decay. Like Nordau also, he turned to science for validation and an interpretive framework, as in the preface to the first of the Rougon-Macquart cycle, his twenty-novel anatomy of France under the Second Empire. The science he there advertises as “the natural and social history of a family under the Second Empire” is essentially evolutionary biology, with heredity and environment doing their worst. But as Michel Serres has argued,<sup>85</sup> thermodynamics finds a systematic analogue in the energies mobilized and expended in these novels. And the trajectories of their human subjects, along with the continuous transformation of the world they reciprocally shape and are shaped by, find a comprehensive organizing principle in the arrow of entropic degradation.

In his polemical scientism, Zola invokes the rigorous determinism of classical mechanics not just in the famous provocation from that same preface, “Heredity, like gravity, has its laws,” but in the composition-of-forces language he there applies to his project. In Zola’s plan, having resolved “the two-fold question of temperament and environment” and established the thread that connects one person to another “mathematically,” to constitute a social group, “I shall show this group at work, as an actor within a historical era; I shall depict it in all the complexity of its efforts; I shall analyze simultaneously the amount of will in each of its members and the general tendency of the whole.”<sup>86</sup> More pertinently than any such vector analysis, however, an imagery recurs through the length of the cycle that

converts action and passion into flows of heat, fevers and contagions, waves of sound and emotion, of accumulation and dissipation, of consumption and waste. Whatever the situation between the physicists and the evolutionists in 1871, the social processes that Zola thinks to embody are conceived ecumenically and registered thermodynamically. The view of evolution as progressive differentiation from a homogeneous primal stock is projected in Zola's prefatory description of a small family group, initially in one place, "spreading forth into ten or twenty individuals who appear at first glance profoundly dissimilar," but whose filiation can be established through "analysis." The language of energy transmission and dynamic transformation mingles with evolutionary discourse when the race is said to "radiate through the whole of contemporary society, rising into all sorts of positions, under that essentially modern impulsion of the lower classes through the social body." Characteristic of the Rougon-Macquart, Zola says, is the "overflow of appetite, the great upheaval of our age, which hurls itself into pleasures."

Zola conceives tracing the course of the Rougon-Macquart as simultaneously recounting that of the Second Empire. He projects in the race an original flaw, "une première lésion organique," expressing itself variously in individuals according to circumstance and accident but also spreading its taint irreversibly, like the poison from the lesion created in the body politic by Louis Napoleon's coup d'état. The projected final result, "the terrible and necessary dénouement of my work," would be the fruit of this progressive corruption, like the eruption of an insidious disease or the bursting of an impostume: the traumatic débâcle at Sedan and the dissolution of the empire. Zola declares that even before the actual disaster occurred, he had found it lying "fatally at the end of the drama." But the drama finds its shaping inevitability in a panorama of two decades where prodigal indulgence and progressive debility unfold amid a fever of activity and the multiplication of objects, where a coherent social fabric disintegrates in an ambiance sanctioning self-serving and self-pleasuring pursuits with no time for the misery at the bottom or for those in free fall, where great resources are dissipated and vast inequalities created and annihilated, ending—despite a final qualification—in defeat and sterility.

The climax of both the incoherent expenditure of energy and its degradation comes at the end of the cycle, in *Nana* (1880), set on the very brink of the war lost at Sedan, and in *La débâcle* (1892), encompassing the Franco-Prussian War itself, the evaporation of the empire, and the violent chaos in its wake. But the process that leads to such collapse is already vividly present early in the series, for example in *La curée* (1872), where the corrupt speculative frenzy surrounding the Haussmannization of Paris, a prodigal investment of energy in dismembering and transforming the city, is the setting for the expensive and demoralizing idleness in the rising generation: Renée, the young wife (from the respectable old bourgeoisie), and Maxime, the grown son of the hardscrabble speculator in real estate Aristide Saccard.

One of the persistent signs, for those who wished to raise the alarm, of the onset of the cultural, social, and biological decadence of European civilization in the approaching fin de siècle, was the erosion of distinctions between the sexes, their degenerative assimilation of each other's physical and mental characteristics, and the consequent threat of population decline amid the failure of procreative will and capacity. Maxime as boy and youth is

characterized as effeminate and effeminized, charming, passive, and vicious. Renée, with whom he grows into an incestuous liaison, takes on androgynous traits. The frenetic activity around them, changing the face of Paris and the structure of society, the driving energy expended in the unscrupulous pursuit of wealth and power, as by Saccard (né Rougon) and his statesman brother, here entail a social and a biological cost.

Renée, who is destroyed in the process, stripped of all she is in the imagery of her own thought, returns near the end of the novel to the dark, near-deserted house of her childhood on the Île St. Louis, its cloistered courtyard in every description characterized by its chill stone silence, its wintery light, its icy fountain, where “one would think oneself a thousand leagues away from this new Paris where all the hot pleasures flamed in the vacarme of millions.”<sup>87</sup> Saccard’s houses, in contrast, are full of “noise, turmoil, fever, lawlessness,” as one critic puts it. In his new mansion especially, “images of heat abound,” including especially the overheated sitting room “where Renée is shown crouching...over an enormous fire which numbs her consciousness of sin and shame,” and the “notorious scene...in which Maxime and Renée are shown making love in the damp, airless heat of the conservatory beyond the windows of which the private park can be seen frost-bound under the moon.” Beyond are the silhouetted black trees and the white lawns like frozen lakes, “a whole dead landscape,” Zola writes. “And this piece of burning earth, this inflamed couch where the lovers lay, seethed strangely in the midst of this great silent cold.”<sup>88</sup> Emphasizing the difference, the thermocline unites the imagery of fever—organic disease—with the representation of society as a vast, wasteful heat engine, dissipating as it consumes, so that it all comes to nothing. Such a thermodynamic difference drives Renée’s passion, but in the end she is returned to the chill of her origins, while in the social world that has consumed and despoiled her, the curée—the butchery of the general hunt—continues unabated. The day of a general reckoning is not yet at hand.

It comes with Nana and *La débâcle*. Nana is a novel of entropic transformation ending in two intercut and counterpointed scenes of chaotic dissolution: the boiling crowd in the nighttime streets, turned from differentiated particularity into a largely undifferentiated mass, and Nana, dying and dead of smallpox in the hotel room above. Punctuated by a great, seemingly anguished exhalation from the boulevard, “To Berlin! to Berlin! to Berlin!” on this day of the legislature’s declaration of war, the revelation of the face of the corpse to the women who have braved the contagion is of a putrid mass of pus and blood, a “formless pulp” with no recognizable features; nothing is left in this “horrific and grotesque mask of nothing” but the blaze of the hair, like sunlight or flowing gold. Zola comments: “Venus [Nana’s first stage role] was decomposing. It seemed that the virus she had absorbed in the gutters, from the carrion tolerated at the roadside, this ferment with which she had poisoned a whole people, had now ascended into her face, to rot it away.” Meanwhile, the “human tide” moves below, “heated by a common fever” and lit by spreading torchlight. It all feels, to Nana’s rival and friend, Rose Mignon, “like the end of the world.”<sup>89</sup>

Zola’s clinical epitaph echoes the language and thought of the article that the scruple-free journalist Fauchery writes about Nana midway through the novel. Titled “The Golden Fly,” it advances much of Zola’s own perspective on the phenomenon that is Nana, though it



fails to capture what it is that brings her to imaginative life. Fauchery identifies her as a child of the slums carrying the taint of four or five generations of poverty and drink, somehow grown into splendor like a dung-hill plant, and avenging the beggars and outcasts of whom she was the product. With her, the rottenness that is allowed to ferment in the people ascends and rots the aristocracy. She becomes a force of nature, “a yeast [ferment] of destruction, unwittingly corrupting and disorganizing all Paris between her snowy thighs, turning it, as women, monthly, cause milk to turn.”<sup>90</sup> The “golden fly” comes out of the dung, picks up death from the roadside carrion, and then in her glittering flight spreads the poison in the palaces by alighting on their male inhabitants (171).

As an embodied force of nature, Nana simply hastens the processes already at work, an entropic slide where expanding, intensifying frenetic motion is the coefficient of dissipation. The narrative stresses the mingling of orders and the dilution of difference; the waste of wealth, land, body, and spirit in a holocaust of expenditure and consumption; the fever that converts everything into heat. Again, the houses speak. Nana’s rich, new, brilliant establishment, reflecting her unflagging “appetit de dépense” sets fashions with its mostly elegant extravagances. The aristocratic household of her principal keeper, Count Muffat, soon takes on its character and coloration, in the general corruption and demoralization of all its members. At the crowded fête that marks “the debacle of this house,” the trembling walls jumping to the heat of the waltz and the ember-red glow of the garden lanterns “was like the ultimate conflagration in which ancient honor crackled and burned on every side” (301). Meanwhile Nana’s household, we are told, glared like a forge where her continual desires flamed and a breath from her lips turned gold into fine ash that the wind hourly swept away. It seemed as if built over a prodigious gulf, swallowing men and their goods (303), whose debris marked her passage as a mangeuse and a gacheuse, an eater and a waster, proud of the ruin of her lovers (237). Even after the collapse and exposure that sends Nana traveling to recoup her fortunes, a tour of the house shows “a heaping up of riches stuffed into the very holes and everywhere overflowing the ruins” (332).

Nana is characterized as an entropic catalyst, affecting all around her and, though as prodigal of herself as of all that comes her way, conserved intact and resilient until the very end. But Zola systematically delineates the progressive disorder of her household, her restless boredom where an equilibrium threatens, her increasing disregard of scale and proportionality, leveling all events, trivial and tragic. Along her trajectory, even sexual and gender differences collapse in lesbian infatuation and cross dressing, one further turn in Zola’s feverish erection of Nana into a hypostatized compendium of all that is dangerous and disintegrative in female sexuality. Zola compares her to a cloud of locusts “whose flame-like flight scours a province. She scorches the earth where she sets her little foot” (322). In one spasm of revulsion that perhaps helps explain the savagery he inflicts on her corpse, Zola writes of her as carrying “an instinctive rage to defile. It was not enough for her to destroy things; she soiled them. Her hands, so very delicate, left abominable traces, their touch alone decomposing all that they previously smashed” (325). Her degrading games with Muffat are not cruelties (she remains “bonne fille”) but first a storm of animal appetite and then—a legacy of the slums—the excitement to be had in debasing the chamberlain dressed for the Imperial Court “to filth, a heap of mud in the corner of the

street” (326).

Degradation in this novel takes the form of reduction to a common denominator in a mingling encounter. Three great public scenes anchor its progress, each with Nana at the center and each registering the transformation of a mixed crowd of individuals into a mass by an indiscriminate tide of feeling. The first, the opening chapter, is in the theater, where the audience, followed from its assembly in the foyer into its places in the auditorium, is caught up in the erotic power of Nana’s debut. Drawn there by “a fever of curiosity,” it is kindled (in Zola’s language) by a hip thrust, “a heat rising from gallery to gallery up to the ‘gods’” (36). After three hours in the stifling atmosphere, the audience is as one: wholly possessed by “the animal rut that rose from her and had spread more and more, filling the house,” fixed in a swooning enervation before the spectacle of this naked Venus netted in the embrace of Mars. And in the face of this vertiginous public, “these fifteen hundred persons crowded together, sinking in nervous disturbance and exhaustion,” Nana remains the unmoved mover, “her sexuality [son sexe] strong enough to destroy them all and emerge unscathed” (41–42).

The second of the great public scenes is the running of the Grand Prix at Longchamp, where Nana in her carriage overlooks the track where her namesake is entered in the race. In its vastness and segmentation, social as well as functional, the scene does not lend itself to ready integration. But Zola achieves its coalescence first through the optics of Nana, then through the dynamics of progressive, engulfing waves of sound and feeling. Just before the race, and with the panorama complete, she stands on the seat of her carriage to sweep the scene: the track, the distant terraced stands, the enclosure, and the fields beyond, “the hundred thousand souls covering this part of the plain, swarming like maddened insects under the vast skies.” As the race is run and the horses come into view, Zola reports the deep roar, approaching with the sound of ocean breakers, “a hundred thousand spectators possessed by a fixed idea, burning with the same gambling fever...pushing, crushing...each for himself, each whipping his own horse on with voice and gesture.” It is the paradox of the appetitive self, joined in the common cry, the “bestial roar” as Zola also names it, that makes the many one. At the finish, the emotion shifts to a great patriotic fervor. As the French horse, “Nana,” under the driving brutality of its (ironically) English jockey, wins over the English horse, “Spirit,” a second wave of sound, “Nana! Nana! Nana!” rolls through the multitude to the horizon “like the roar of a rising tide,” through the living mass in the stands, to the distant common people camped under the trees, only to return, spreading and enlarging, until it reaches and engulfs even the imperial tribune (281).

The final such episode is the night scene in the streets outside Nana’s window, the crowd in motion bespeaking the delirium of the nation caught up in the war fever, rushing, we are told, sheeplike to the slaughter, howling its punctuating cry, “To Berlin!” as if in an exaltation of terror and self-pity for the coming massacres. In all three cases, the negation of difference in the mass accompanies the mobilization and release of energy and its transformation downward, into heat, erotic, appetitive, or chauvinistic-aggressive. Moreover, for Zola the last episode marks the breaking up of the heretofore intact surface, mined by the fires within and heralding the collapse of organization and purposeful coherence into anarchy. It heralds the collapse of the whole body politic, whose inward rot

is fearfully made manifest in the sudden corruption and dissolution of a woman's flesh.

La débâcle as a title lacks the classically tragic and heroic, not to mention religious resonances of Camus' "La chute," ("The Fall"). It intimates a sudden breakup or collapse, as of an ice dam in a stream, releasing the pent-up waters. But there is also something of the pratfall in a débâcle, of overblown pretensions exposed and undone, a humiliating tumble as opposed to a fall from authentic greatness evoking tragic awe. Though the collapse in La débâcle is sudden, it is the last term in a series that has been building remorselessly. It is where Zola's plotting the course of France's Second Empire, along with the fortunes of the Rougon-Macquart, was supposed to come out. Inevitably, in evoking the actual military defeat and its immediate catastrophic consequences in this novel, Zola recapitulates the prodigal history of energy dissipated, motion and resources wasted, of progressive confusion and ultimate paralysis. Perhaps that is why, as a novel that seeks to articulate not just the chaos itself but the forces that transform the human capacity for making and doing into ineffectual incoherence, the architecture is surprisingly regular: three sections of eight chapters each, a first act, the lead up to the decisive battle; the second, the battle of Sedan itself; and the third, its chaotic aftermath, through the siege of Paris and the Commune.

A great battle, especially a decisive one, takes on apocalyptic lineaments, and a narrative that ends amid the burning of Paris understands the uses of violent catastrophe. At the level of causation, however, and in the play of circumstance, Zola's novel registers a more gradualist understanding, where catastrophes emerge from the workings of Darwinian processes and physical laws. The sharpest perceiving mind in the narrative, despite his congenital neurotic instability, is that of Maurice Levasseur, whose enthusiasm for the war dates from the night of the great crowds in the street that concluded Nana. But Maurice is also for war as "believing it inevitable, necessary to the very existence of nations. He had been convinced of it ever since his acceptance of evolutionary ideas, of that whole theory of evolution which since then has so fascinated lettered youth."<sup>91</sup> As quick to grasp as to enthuse or despair, his perception of the disaster in the making leads him to recall the comparison made by his Alsatian brother-in-law, between a declining France and a youthful, forceful Germany, France "rotten at the base," gradually enfeebled by the destruction of liberty, the selfish pursuit of pleasure, a belated liberalization, the complacency of its military (697). "Woe to him that halts in the unrelenting efforts of nations," Maurice reflects; "victory is to those who march in the vanguard, to the cleverest, the healthiest, and the strongest" (732). But in the same bleak hour, he deduces "mathematically" the course of the coming defeat, the inevitable result of "the shock of unintelligent bravery against superior numbers and cool method. No point in arguing about it later, the defeat, despite everything, was inevitable, like the law of the forces that drive the world" (731).<sup>92</sup>

French military doctrine resting on élan, combining heat and thrust, speaks in this view of its failure, the heat dissipating in its encounter with the cool larger body. Other aspects of the complementary workings of energy and entropy mark Zola's account. The Germans—likened to the purposeful swarms of locusts and ants—are endowed with force, cohesion, and directionality; the French lose their effectiveness in a dispersed deployment and in wasted, uncoordinated motion, indecisive advances and retreats, forced marches and

repositionings that are merely exhausting and demoralizing. The commanders look out for themselves or are incapacitated by the indecisiveness at the top. On the field, hearing of changes in command and reversals in plan as the battle gets underway, a horrified Maurice points to the contrast: "He felt the confusion, the utter disarray into which the army was falling, with no chief, no plan, dragged in every direction; while the Germans were making straight for their goal with the linear precision of a machine" (857).

Disaster on the field, defeat of the French army, and the emperor's surrender produce a memorable detailing of the concurrent spreading dissolution: as in the incremental chaos in the town of Sedan, its chief factory turned into an overflowing receiving hospital, the piles of limbs and corpses growing, dismemberments in progress; the mass flight of the army, now a mob, a muddy stream of regimental fragments heedless of unit or rank; the frightful anarchy of the prisoners' holding camp in a bend of the Meuse. Such are the immediate consequences of defeat, much of it familiar imagery in the representation of chaos and war. But they are as well the surfacing consequences of the silent erosions, the long undermining fevers (still so prominent in the imagery), in the society of the Second Empire. Maurice, in a characteristically extreme agony of despair, sees all in terms of his own family history, the descent from Grand Army hero, to provincial petty bureaucrat, to himself in three generations, and this "degeneration of the race" writ large "crushed his heart, like a hereditary disease, slowly aggravated, culminating in fatal destruction when the hour had struck" (954).

*La débâcle* in its own right is one of the nineteenth century's towering representations of the panorama and particularity of war. In seeking to anchor it in a scientific understanding, Zola is as much at odds with Tolstoy as Tolstoy with Clausewitz, but *La débâcle* is not without a perspectival complexity that qualifies deterministic (scientific) generalization on war. Moreover, in Zola as in Tolstoy, war takes its meanings from what we call peace. At one point, after an episode of ferocious local combat both brutal and heroic, Zola vouchsafes in the dying eyes of Captain Rochas (his embodiment of the French soldier's blinkered assurance and professional fighting spirit) something of "the true vision of war, the atrocious struggle for life [*lutte vitale*] that one should accept only with a grave and resigned heart, as one does a law" (944). But it would be grossly reductive to read the novel as itself making such a gesture of stoic acceptance or to limit Zola's own embodied views to Maurice's formulaic social Darwinism. In the multiple, indirectly voiced perspectives associated with particular sensibilities, there is powerful resistance to war as the mandate of nature, let alone an instrument of progress or sanitizing virtue. The sufferings, atrocities, and waste of war have too large a presence for that, overwhelming any rationalistic frame and imputed purgative effect, as when the steady and sensible Jean Macquart, Maurice's alter ego, a soldier and distant relation, is an anguished witness to the terrible butchery of a trussed German spy, bled like veal in a farm kitchen by partisans. The German has been trapped with the help of the desperate peasant woman with whom he has had a child, who also becomes a witness. The regressive, indeed degenerative agency of war, and war as self-perpetuating futility, appear in Jean's interior cry, "Ah! war, abominable war that has changed all this miserable lot into ferocious animals, which sows such fearful hatreds, the son bespattered with the father's blood, perpetuating the enmity of the races...villainous



sowings for appalling harvests” (1054).<sup>93</sup>

Jean's is also the voice, from the patient, tenacious reservoir of rural France, that brushes off Maurice's despairing pronouncement on the nation as now finished, that finds a virtue in purgation and excision of its rotten parts and looks to a fresh beginning. And indeed, when Maurice gets to Paris, a city preparing to resist, he finds it apparently purged and healthy once more. Yet, within a page, the imagery of nervous disease and epidemic fever reasserts itself, and later, in the Paris of the Commune, where Jean and Maurice find themselves on opposite sides, it reaches the pitch of “a fit of dementia that possessed all Paris, this malady of distant origin, stemming from the foul leaven [ferment] of the previous reign” (1086). The Commune is represented as the final dissolution of civic order, republican order, into anarchy, its very failures, divisions, and incompetencies feeding Maurice's nihilistic rage and fantasies of catastrophe on a cosmic scale. The last stage of the debacle is the fratricidal conflict, whereby the Commune is suppressed, between an exasperated conservative France and a febrile idealistic France, symbolized in Jean's bayoneting of Maurice, his friend and elective brother, the last fighter on the barricades.

Maurice on his deathbed recalls Jean's imagery of lopping off the rottenness, of profiting from a hard knock to start afresh and go on. And Maurice adds, “It is the healthy part of France, balanced, reasonable, the peasant part, which has kept closest to the earth, that is suppressing the crazy, exasperated part, spoiled by the Empire, unhinged by fantasies and pleasures” (1117). But he dies, Zola says—the authorial voice overlaying the thoughts of Jean—“hungry for justice, in the supreme convulsion of his great black dream, this grandiose, monstrous conception of the old society destroyed, of Paris incinerated, of the ground ploughed up and purified, so that there might spring from it the romance of a new age of gold” (1121). Yet, though the scene outside the windows is certainly in keeping with Maurice's catastrophist imagination, it is the gradualism implied in Jean's patient task of rebuilding, based in a faith transcending the spectacle of destruction and the accumulation of disaster upon disaster, a faith in “the certain rejuvenescence of eternal nature, eternal humanity,” that would appear to have the last word. Maurice is taken, Jean is left.

Still, in *La débâcle*, the primary symbolic key to rejuvenescence is cut off, in the sterility of the actual ending: the failed possibility of a union between Jean and Henriette, Maurice's sister, given the blood that now lies between them. Zola's newer sense of the possibilities of idyllic renewal from the ashes of the debacle would come into full figuration in his coda to the Rougon-Macquart cycle, *Le docteur Pascal* (1893), notably in the character of its eponymous life worshipper and the symbolism of birth, which is also rebirth.<sup>94</sup> But in the narrative conclusion of *La débâcle*, offering disjunction, loss, and irremediable impasse, there remains something of the original conception of the Rougon-Macquart cycle, where “the necessary and terrible denouement of the work,” as of the system and the era, could not admit of reversibility.

## VOX CLAMANTIS

As the West weathered the fin de siècle and moved into the twentieth century, it brought

along competing models of chaos—one, the chaos of energy, the other of entropy—for imagining the present and the future. On some writers and thinkers, both models made a claim. Henry Adams, as noted, was a case in point, though in fact, in imagining the recent past, Zola also bestrode both avenues to the destruction of sanative order. In Zola's world, as in the science of heat and motion, energy itself is conserved, but not so the forms it takes in life or society. When these decay, the energy released, however degraded, persists. Nana, a fruiting body of the anarchic and degraded energy of the slums, is an irrepressible survivor as well as an agent of degradation. Restless and reckless, no less of herself than of others, she is imagined as a primitive force, like war, which similarly reduces and consumes depleted higher forms. When Nana succumbs in the arbitrary and therefore all the more symbolic ending, her energy is not lost; it is transformed to and by something still more primitive and anarchic, the virulent disease that dissolves the shape and substance of her face and flesh. Humanity and identity are degraded and lost even as the complex humanity of the civilized state is degraded in the random flux and collective madness of the crowd. It is no accident that Zola's representations are nearly contemporaneous with Gustave Le Bon's pioneering treatise on the crowd, his *Psychologie des foules* (1895), whose dark summation Henry Adams would quote in his own venture into aligning the cosmic and human debacle.<sup>95</sup>

When faced with drowning in “an ultimate ocean of Entropy,” in Adams's phrase,<sup>96</sup> with alarming intimations, social, environmental, and anthropometric already in evidence and with a public mostly oblivious, impasse, resignation, impotence, and paralysis were not, fortunately, the only reasonable response. Even among the most scientifically informed, there were alternatives to resignation and despair, things that one could do. That was the message of the physicist Bernard Brunhes. In the fictions of a Wells, a Flammarion, a Chekhov, finding a connection between the physics of energy and the fate of the natural environment with its human and other inhabitants required only a modest imaginative leap. But in the sciences proper, it took more strenuous efforts to bridge the gap between disciplines—physics and evolutionary biology together with geology—whose divergent development had fostered a certain amount of elective hostility. Bridging the disciplinary gap was helped, as often, by an emergent third party, the modern form of “human geography.” Such appears to be the case in Brunhes's neglected classic of science writing for a general public, an exposition of energy theory, its development and reception, and of the operations of the second law of thermodynamics.

Brunhes was a professor of physics with an interest in meteorology in industrialized Clermont-Ferrand, best remembered as the discoverer of geomagnetic reversal (1906). Not irrelevantly, he was brother to Jean Brunhes, whose great work, *La géographie humaine* (1910), was a foundational text in that eponymous modern discipline. A major section of Jean's text is devoted to the essentials of “l'Économie Destructive,” meaning the mindless extraction of mineral resources and the devastation of plant and animal life with no thought for renewal. He there points to a growing reaction to such “Raubwirtschaft” and quotes extensively from his brother's *La dégradation de l'énergie* as “the scientific work that best condenses the new philosophical tendencies.”<sup>97</sup>

As a physicist, Bernard Brunhes is writing on the cusp of the transformation of classical

physics into something else. He writes with informed awareness of the historical development of energy theory, its speculative and philosophic outgrowths, and controverted issues: “the dematerialization of matter, as some call it” (205), in the newly established complexity of the atom and the explanation of the properties of matter as electrical properties; the various continuing challenges to mechanism; stochastic explanation of entropy, as in Boltzmann and Gibbs, and scenarios for the reversal of the direction of probabilistic entropy; and the philosophical challenges of “the new positivism,” which unfixed the very foundations of scientific theory and fact. He cites approvingly Ernst Mach’s relegation of the whole panoply of conservation laws, culminating in that of energy, to theology, as stemming from a dubious Cartesian analogy between conservation and the supposed immutability of the creator of the universe. The law of the degradation of energy, on the other hand, unlike conservation, Brunhes sees as “forced by a resistance of reality to our conventions” (375). He also finds some irony, given the Cartesian analogy, in the eager embrace of a highly metaphysical conservation principle by those made nervous by the idea of a Creator. To balance Henri Poincaré’s last-ditch formulation “There is something in the world that is conserved” (389), he insists, “There is something in the world that is constantly being lost” (375). Early in Brunhes’s exposition of the various forms of energy, he takes up the question of why the molecular motion associated with heat is not integrally transformable into usable mechanical energy and finds the answer in its uncoordinated, disorderly nature. That leads to a definition whereby “order in the material universe is the mark of utility and the measure of value; and this order, far from being spontaneous, tends constantly to its destruction.” He then quickly moves to cut off speculation that might find in a final, universal disorder the automatic makings of a new beginning: “The disorder towards which a collection of molecules proceeds is in no way, moreover, that initial chaos, rich in differences and inequalities generating usable energies; it is, on the contrary, the equality and homogeneity of an average state with an absolute absence of coordination” (53).

*La dégradation de l’énergie* (1908) is not simply an exposition, however. It is an argument rooted in the belief that the neglect, not to say eclipse, of the concept of entropy, compared to the widespread knowledge and pervasive influence of the idea of the conservation of energy, was a serious threat in the present and to the future of the world we live in. What Brunhes saw was that, with no understanding of the costs of energy expenditure, the comfortable notion that nothing is ever lost or destroyed in the energy economy and that things will right themselves or balance out in the long run was proving irretrievably ruinous in its partnership with the licensed economic individualism of the industrial age.<sup>98</sup>

Brunhes’s intention is to annihilate that discrepancy in knowledge and awareness and so make a contribution to retarding the entropy of the system, a contribution at least as meaningful as his personal efforts (like Astrof’s) in reforestation of the Puy de Dôme, site of the observatory he directed. But the treatise is no mere polemic. Rather, in the form of a lucid history, systematic exposition, and theoretical survey, it brings information itself into the thermodynamic equation—something Maxwell had done implicitly in inventing his hypothetical “demon” and that Norbert Wiener would do emphatically in foregrounding his “feedback” principle.

Alert to its importance in shaping attitudes, Brunhes places a great deal of weight on the language that expresses entropic transformation, the language that furnishes his title. He credits the British scientist Peter Guthrie Tait with the terminology that makes his point most effectively and drives home the reality that the “conservation” formula has managed to obscure. Energy in its transformations “degrades.” That is to say, in the natural course of things it loses utility and availability. In Brunhes’s view, the terms “transformation” of energy (the Latinate equivalent of “entropy”) and even “dissipation” are inadequate to the task of expressing the difference between quantity, which is “conserved,” and quality, which is not—the aspect that “degradation” captures perfectly. The end of all, like the direction of things, is glaringly plain for any closed system:

Rest, uniform temperature—such are the final conditions progressively realized through spontaneous transformations. If such is the end state reserved for the universe as well, clearly it will be death pure and simple: without motion, without temperature inequalities, no radiation, no possibility of life. In this dead and extinct world, however, there would be the same total sum of energy as in the first days of its existence.<sup>99</sup>

But if such be the end of things, in the very considerable prior time human beings have a power to affect the process in its local workings, and with that come responsibilities. Brunhes denies a contradiction between evolutionary doctrine and the principle of the degradation of energy, though he is scornful of the philosophy that asserts a law of “universal progress.” He starts with the proposition that “living beings have as their role retarding the degradation of energy in the world,” a role they can perform well or ill, consciously or unconsciously, from the plants that capture and store solar energy that would otherwise dissipate to the man who makes use of the wind or a fall of water to turn a wheel. At every level, “all that lives is capable of increasing the fraction of the energy of the universe that is put to use [utilisée]” and not squandered (gaspillé). Evolution he defines as the augmentation, in whatever realm, of the *énergie utilisée* of the universe, a category that can grow, in contrast to the immensely more abundant *énergie utilisable*, which can only diminish (194–195). Brunhes compares the planet within the solar system to a vast island risen out of the sea, subject to a gradual subsidence even as its settlers progressively cultivate and improve it. But, he warns, “living beings and especially man, capable of slowing to a degree the degradation of energy in the world, are also capable of accelerating it, as too often happens.” He continues:

It has been said by [Wilhelm] Ostwald that civilization consists of the art of making use of the raw energy of nature.... But not all the advances of civilization are equally good. If man’s actions are always limited by the impossibility of getting the world to go backwards, he still has the power to retard or accelerate the degradation. Industry, beneficent when it retards the degradation of energy, does harm when it causes it to accelerate in practicing the devastation of nature, *Raubwirtschaft*. The “free play of the natural laws” includes the universal tendency to dissipation of the useful forms of energy; the extent to which a given era struggles against this tendency may be taken as the measure of its degree of civilization. In this respect, the worst barbarians are some of the “civilized.”

(196–197)

Since Nature—which he cannot find “good,” for it wears out continually—is susceptible both of improvement by true civilization and of being made worse in the hands of the civilized barbarian, Brunhes is able to reformulate the question argued by Rousseau, of how the



social state measures up against the state of nature. Brunhes would ask, simply, “Does the society bring about an acceleration or a retardation of the degradation of energy in nature?” (196–197).

That the material world wears and dims, heading toward a chaos that is at the furthest extreme from the energetic turmoil of its putative beginnings, is where Brunhes begins and ends. “Degradation” means reduction to a common term in a featureless soup of more or less uniform tepidity. But knowledge brings power, and with that knowledge Brunhes speaks as a prophet in the biblical mode, declaring not simply what will happen but what can be done to avert (or at least postpone) the worst that can happen. His analysis and its conceptual leap will find a vibrant succession in our own anxious time, in the resource-conscious “thermoeconomics” and “biophysical economics” that ground themselves upon factoring in the costs and consequences of the second law, those factors that advance or retard the tide of entropy.<sup>100</sup> But as a prophet, in his final word, Brunhes offers admonition in a form that resurrects the chaos of violent energy expressed in a work of destruction. He returns to the Puy de Dôme, its fragile soil denuded by overgrazing: “When the torrent, created by the denudation of the slopes, will have joined with other torrents and formed a capricious river which will devastate the villages and choke the plains with sand, will someone then have the nerve to say again that in the world ‘nothing is ever lost’?” (388). In its immediacy and concreteness, the ecological nightmare returns as a vision of catastrophe.

Knowledgeable, impassioned, and unlike some of his predecessors free of preoccupations with the epiphenomena of cultural decadence, Brunhes manages to offer a rational basis for useful and responsible behavior in a thermodynamic regime, in place of either reckless abandon or narcissistic pessimism. As a scientist and thinker, he is a notable precursor of the promising turn that brings thermodynamics to bear on economic and ecological analysis. As a man of conscience, he suggests what it is to live ethically, and what it means for a society to be “civilized,” in a world built on the mustering of useable energy but subject to the exactions of the second law.

## **ANARCHY AND ENDGAME**

What I am saying does not mean that there will henceforth be no form in art. It only means that there will be new form, and this form will be of such a type that it admits the chaos and does not try to say that the chaos is really something else. The form and the chaos remain separate. The latter is not reduced to the former.... To find a form that accommodates the mess is the task of the artist now.

—Samuel Beckett

The imagination, or perhaps one should say the mindset of the twentieth century and after, seems more at home in the company of endemic chaos than in earlier times, primed to see chaos as fundamentally countercosmic. It was, of course, the fruit of experience in all ages that things fall apart. Moreover, the incorrigibly human thing (not on the whole bad) would seem to be a disposition to pry them apart. It is the method of science, as Wordsworth famously complained: “We murder to dissect.” We analyze and isolate, though often in

order to construct. But coming into the twentieth century, something more seemed to be afoot, even in the sciences. Gerald Holton, writing in the late 1960s of the cognitive leanings of science at various times, observes that although inherited concepts of hierarchy, continuity, and order remain strong in contemporary science,

they are not the new themes that correspond to the characteristic style of our own age—of which one of the most powerful and significant is the antithetical thema of disintegration, violence, and derangement. Thus in the language of physics alone we find the rise in the last six decades of terms such as radioactive decay, or decay of particles; displacement law; fission; spallation; nuclear disintegration; discontinuity (as in the energy levels of atoms); dislocation (in crystals); indeterminacy, uncertainty; probabilistic (rather than classically deterministic) causality; time reversal; strangeness quantum number; negative states (of energy, of temperature); forbidden lines and transitions; particle annihilation.<sup>101</sup>

And, he suggests, between style in science and style in art—one might say style in thought and in cultural expression—there is an affinity. Again, it is a matter that goes beyond the common analytical impulse, so exceptionally prominent in the modern avant-garde's preoccupation with the means of art. The interdisciplinary literary scholar Karl Kroeber, tracing developments in the understanding of art, suggests that Romantic notions of the autonomy and uniqueness of the work of art opened the door to accepting such inner order "as perhaps disordered, or even anti-ordered by the standards of systems of other art or of nonartistic reality.... Seen in this perspective, recent deconstructionists merely pursue to one logical extreme a century-old tendency to locate in disruptive and decentering phenomena the essential qualities of artistic form." That is, from seeing the credentials of the work of art as lying in its disruptive originality, it is only a step to seeing it as self-subversive. "So far as the work is dynamic, then, we may reasonably expect its 'purpose' to be an inherently self-contesting one. It was early in this century, we should remember, that Picasso spoke of his art as a sum of destructions."<sup>102</sup>

Picasso, in his endless transformations but notably in his early challenges to conventional representation of the object, belongs among the anarchists in art, those more committed to enacting the chaos than to representing it by symbolic indirection.<sup>103</sup> But in so far as the explosion of the object in the cubism that first brought him notoriety engaged not just objects unbundled in space but how one knows them and constitutes them in thought, Picasso links to those recent turns in scientific thinking that insult the Euclidean imagination and make chaos our familiar. This series of turns begins, it is fair to say, with the probabilistic account of entropy and the statistical base it must rely on, a way of coming to terms with intractable limits on our knowledge of an independent physical reality and finding a way around them. Such inherent limits upon "objective" knowledge, limits not to be transcended or eliminated, are now commonly accepted as in the nature of things. They accumulate in the twentieth century as "undecidability" in mathematics, "uncertainty" in quantum physics, "unpredictability" in complex natural phenomena as well as in events on the very smallest and very largest scale.

The result for many of those moderns who attended to such things, or who experienced their unsettling reverberations, even among scientists, was to feel that the foundations themselves were at risk, compromised by the unknowable and the unimaginable. And if the silver cord was loosed, it was loosed for everything. But when imagination sought to bring

such insights home on a more human scale than that of the quantum or the Big Bang, the quest for expressive form allowed of a palpably divided approach to the phenomena associated with “entropy.” The ambiguity inherent from the start, between entropic loss of structure on the one hand and loss of significant difference on the other, between anarchic dissolution into the many and homogeneous approximation of the one, now came again into its own. In much of classic twentieth-century modernism, Holton’s tropes of dissolution, fragmentation, and disruption and their enactment in analogous form are assimilated to an entropic premise. The disorder of the *Waste Land*, offered as a collection of fragments in Eliot’s poem of that name, is also a stage on the way to a comprehensive, if spiritualized, nothing. Moreover, its formal discontinuities, enhanced by Pound’s excisions, support the anarchic representation but also move the poem toward the schematic enactment of one kind of minimalism.

By and large, the entropic vision finds expression in narratives of progressive decline and dissolution, some looking back, using a strategy of implicit contrast to earlier states and times (consider that Joyce’s *Ulysses* reduces Homer’s spacious Mediterranean to the streets of a single city and Odysseus’s ten years to a single day), and some looking forward, to the endgame. It is in the endgame where the paradox of a terminal chaos that is also terminal order fully manifests itself and where the approach to homogeneity in the absence of significant movement, difference, change, allows the mathematics of the zero state to emerge from multitudinousness. But short of that approach to a final condition, narratives of entropic decline in a milieu marked by “disintegration, violence, and derangement” speak to an age where the second law is no longer eclipsed by the complacent face of conservation and equilibration. In some, the science itself advances into the foreground with its versions of chaos, giving focus to both social and metaphysical anxieties and bridging to the revolutionary revision of the nature of things in the new century.

## RESISTANCE AND COMPLEMENTARITY

The convenient working assumption that neatly separates the world as it is from the world as it is imagined runs into trouble in the science of the twentieth century, though with anticipations in the science and philosophy of the nineteenth. From a practical standpoint, one might ask whether something like a new theory of disorder, and an extensive if heterogeneous effort to embody it in imaginative form, were mere epiphenomena, making no real difference in daily life or the sweep of human history. It was one of Oswald Spengler’s insights that giving chaos a new conceptual form did indeed make a difference and that a theory of the world, even framed as a scientific description, was at the same time a theory in the world, a diagnostic with expressive and symbolic force.

Conceiving his grand historical task in writing *The Decline of the West* as seeking (like Goethe) “the Destiny in nature and not the Causality,” Spengler proposed to determine the stage in the historical cycle occupied by Western Europe and America between 1800 and the coming millennium by attending to “the organic and symbolic meaning” expressed in its institutional and intellectual forms (Formkomplexe).<sup>104</sup> With such considerations in mind, he

identifies the notion of entropy, as formulated in the second law of thermodynamics, as “the most conspicuous” among the “symbols of decline.” He believes that by introducing irreversibility and admitting the gap between ideal theory (reversibility) and actuality, the reification of entropy registers “the beginning of the destruction of that masterpiece of Western intelligence, the old dynamic physics.” He goes further in diagnostic application: the notion itself is “inwardly clear and meaningful, but is formulated differently by every different authority and never satisfactorily by any. Here again the intellect breaks down where the world feeling demands expression” (1:420–421). Equally significant (that is, symptomatic) is the hypothesis of elemental disorder, an attempt in Spengler’s view to bridge the gap between the theoretical and the actual, to reconcile the first and second laws. Founding a world and our knowledge of it on the premise of an elemental disorder means being thrown back upon the “Calculus of Probabilities [so that] in lieu of exact we have statistical methods.” But here Spengler finds a glimmer of positive gain. For inasmuch as statistics serve to characterize “political and economic, that is, historical developments,” they belong to the domain of the organic, of life, incident, and “Destiny” and not to the world of laws and causality. A calculus of probabilities “means that the object of understanding is ourselves” (432).

Spengler’s organicist, comparativist charting of a law of civilization and decay puts him in the direct line of the nineteenth-century philosophers of history. But with his view of entropy as both symptom and science, with the implication that generating a particular description of reality changes what is described, with his willing acceptance of probabilistic succession, with his reflexive identification of the subject and object of inquiry, Spengler takes his place in the twentieth century. He gives scope to a double consciousness that at one and the same time rejects the dualisms of a classically stable universe (mind/body, self/other, cause/effect, is/is not) and opens the way to a relativistic conception of the subject-observer and to the disjunctive inclusiveness of quantum complementarity. Gillian Beer, writing on the predisposing force of “wave theory (as thermodynamics continued to be called)” on modernism in the arts and criticism, has in mind not only the destabilizing of the material order and the relativizing of observation but the branching existences whose analogue in language is the rhetorical figure of zeugma (e.g., Pope’s mischievous “stained her honour, or her new brocade”). “The acceptance of multiple, incommensurable outcomes driven by a single verb opened the way alike to modernist literature and thought and to wave-particle theory.”<sup>105</sup> In place of contradiction (if A, then not B) as the umpire of identity, there is complementarity (if A or B, then AB). “AB” can accommodate the quantum as wave and particle; it can even accommodate its being, so to speak, both here and there. As a measure of the conceptual distance traveled: Oedipus cannot be himself and another, and he resolves the riddle (and dissolves the contradiction) when he looks. Schrödinger’s subatomic cat in a box is both one thing and another (alive and dead) and remains so, some argued, until one looks.<sup>106</sup>

Where the entropic vision finds expression in modern narrative, versions of complementarity often enlarge its possibilities, release it from linearity and inherited canons of realism. But such complementarity is not an arbitrary modernist infusion; indeed, it seems to grow directly out of what appeared paradoxical from the first in the notion of



thermodynamic disorder (a multiplying incremental confusion approaching terminal homogeneity). It also gives scope to all that impels intuitive resistance to the second law's coercive fatality. In Faulkner's modernist classic *The Sound and the Fury* (1929), for example, a historical thread of entropic decline, time bound and directional, exists complementarily with a surface that is elaborately disjunctive. Appropriately, the decay of the Compson line and its ultimate dissipative scattering plays out under a title that disputes any teleology beyond mortality in the succession of tomorrows and in a narrative that disputes temporal coherence. Beginning with a present collocated out of vanishings, a disordered patchwork of inner and outer sensations where the immediate and the long gone coexist in the mind of a speechless (but not voiceless) idiot, the narrative ends with the episode of his human response to the violation of an arbitrary but accustomed order—an "order" that qualifies as such only because familiar. The "horror; shock; agony eyeless, tongueless" that Benjy then registers, as the surrey goes left around the monument in the town square instead of right, vanishes instantly when the surrey is swung about and "cornice and façade flowed smoothly once more from left to right; post and tree, window and doorway, and signboard, each in its ordered place." No more ironically devastating assertion of the fictive nature of meaningful order in the space and time of a probabilistic universe ruled by entropic decay comes to mind.

It is true that, unlike the course of events in *The Sound and the Fury*, the narrative vehicle becomes more ordered from first to last, through the four sections and voices that constitute the novel: Benjy's, Quentin's, Jason's (all siblings), and the concluding third-person "omniscient" narrator's. But the sequence, precisely dated, breaks chronology: April 7, 1928; June 2, 1910; April 6, 1928; April 8, 1928. Chronology, as Sartre points out, is not identical with temporality. Still, "Nothing happens," he writes in his essay on time in *The Sound and the Fury*. "The story does not unfold; we discover it under each word."<sup>107</sup> And that is because "Faulkner's present is essentially catastrophic" (88). The narrative, however, speaks as a flight from temporality whose flow is nevertheless inexorable and undeniable, as Quentin in his segment makes experimentally plain. Quentin's stream of consciousness, in the past tense entirely, is all about trying to lose time (not recover it as in Proust) and so cancel the losses. The future tense enters his discourse only in the passage near the end where he allows himself to think, "A quarter hour yet. And then I'll not be."<sup>108</sup> The emblem of his endeavor and its futility is his grandfather's ticking watch whose hands he has wrenched off as he starts his haphazard course through his last day, a vivid echo of a pertinent passage in James Thomson's poem answering how life can still live after faith, hope, and love are dead:

Take a watch, erase  
The signs and figures of the circling hours,  
Detach the hands, remove the dial-face;  
The works proceed until run down; although  
Bereft of purpose, void of use, still go.<sup>109</sup>

Time passes anyway, and the clock runs down toward silence.

In an opposite sense and to another purpose, the clock in the Compson kitchen keeps going. It belongs to Dilsey, the black servant at the heart of the Compson household, and it

labors under severe disadvantages. Set up where she works singlehandedly to preserve the daily routine in the face of a constant drag toward chaotic disintegration—making breakfast, getting Luster (Benjy’s minder) to dress him, dealing with Mrs. Compson’s self-pitying demands—Dilsey’s clock evinces “an enigmatic profundity because it had but one hand.” When it strikes five times, Dilsey knows that it means eight o’clock. With Dilsey, the imposition of measure on time means recruiting it to her conserving, sustaining, antientropic agency, her resistance to the manifold subsidence and dilapidations that nevertheless corrupt the flesh and the spirit. When she fails, so does the clock—as in the quiet moment after Jason leaves in pursuit of his runaway niece, whom he has robbed of money and love and who now has robbed him. The sound of the kitchen clock is then no more than an empty rhetoric covering rot and decline. It degrades into noise, part of the idiot’s tale, signifying nothing: “The clock tick-tocked, solemn and profound. It might have been the dry pulse of the decaying house itself; after a while it whirled and cleared its throat and struck six times” (85).

Sartre complains that Faulkner cuts off the future; that in his vision of the world, the past becomes hard while the present remains soft. The vision of the world, he says in a specially apt image, is that of a man sitting in an open car facing backward, with formless shapes rising on either side, only afterward becoming tree and men and cars. But in fact the future is there, both soft and hard, in the tragic complementarity between disorder in the turmoil of living, rich with improbabilities, and the entropic temporality that lights all (as Macbeth notes) in the direction of the highest probability: to dusty death.

The chaotic tendency of a world fallen under the dispensation of entropy, and the resistance offered by minds driven to extract pattern and meaning from the multiplying fragments, furnish the signature subject of Pynchon’s work. Yet it is also true that his narrative inventions, often wildly comic, elaborate a suspension of classical premises whose penitentiary surface in the track of thermodynamics itself. When a notion like entropy serves as a template in the design of a fictive reality, as in Beckett, for example, it engages the means of the discipline: how the narrative is organized, how its issues are or are not resolved. When it chiefly supplies a metaphor, attention falls on its referent: on the way society is changing for the worse, for example, as it were entropically. But entropy for Pynchon is no mere metaphor, and when it enters the conversation—as in Pynchon’s early short story titled “Entropy” (1960) and in the short novel *The Crying of Lot 49* (1966)—it can be hard to tell which is the tenor and which the vehicle. Pynchon plants such relativistic complementarity in a much cited remark on metaphor in *The Crying of Lot 49*, when its protagonist, Oedipa Maas, considers the capacity of the Word for both “buffering” and penetration: “The act of metaphor then was a thrust at truth and a lie, depending where you were: inside, safe, or outside, lost. Oedipa did not know where she was.”<sup>110</sup> That is, she is unsure of her relativized observational situation. Otherwise, she is at that moment in a flophouse cradling a dying sailor racked with delirium tremens, metaphorically (etymologically) the “trembling unfurrowing of the mind’s plowshare.” As the DTs, but in lower case, it

meant also a time differential, a vanishingly small instant in which change had to be confronted at last for what it was, where it could no longer disguise itself as something innocuous like an average rate; where velocity dwelled in the

projectile though the projectile be frozen in midflight, where death dwelled in the cell though the cell be looked in on at its most quick.

As  $dt$  or  $\Delta t$ , the term embraces motion and arrest, like Beckett's image of birth astride a grave. Metaphorically apt, though only noticed through an outlandish linguistic coincidence,  $\Delta t$  operates as a fiction of limits to plot the time series that constitutes the asymmetry, the directionality, of the second law.

Oedipa has been set in motion by being made executor for the estate of a former lover with jokey tendencies, an entrepreneur the debris of whose omnivorous empire includes large tracts of California real estate. Her mission to find and connect the pieces, however, comes to include not just those remains but the traces of a mysterious and clandestine resistance to absorption in the corporate state and tuned-in society, a covert alternative way whose character, linkage, and indeed reality are elusive and become more so, not less, the more evidence Oedipa discovers and collects.

The California (the nation and, by extension, the world) that Oedipa encounters, for all its quirks and crackpots, is being pressed toward a lobotomized homogeneity, its energy (like her late lover's) all compulsive bounce that accelerates the actual running down. The elusive resistance seems to take the form of a free-standing clandestine communications network for those left out or wanting out. Its name ("Tristero") and muted post-horn symbol are putatively descended from a loser in the struggle over European postal monopolies in the days of nascent capitalism and emergent states. Communications theory enters the puzzle through its having borrowed the language of thermodynamics to describe the degradation of signal amid the plethora of noise.

Novelistically and referentially—that is, as fictive formal resolution and as metaphoric thrust at the world outside—the issue in the end comes down to the degree of "reality" in the Tristero mystery. The prospects, however slim, for reversing entropic decay (whose classical formulation says it can only increase) in civil society (where it is, one can hope, metaphoric) hang on that issue as well. But despite the conventions of narrative and the reader's expectations of cognitive and aesthetic resolution, the end declines to provide such comfort, which in any case would be false to any actual present, pregnant with alternative futures and conditioned by future elections. Oedipa attends the title auction, where the appearance of a mysterious bidder at the crying of lot 49 might be conclusive for her and us, but the novel ends as the auctioneer clears his throat. Oedipa's take on her present position is that "there was either some Tristero beyond the appearance of the legacy of America, or there was just America," and if just America, then the only way she could continue, and be relevant to it, "was as an alien, unfurrowed [i.e., demented], assumed full circle into some paranoia." Earlier, the explanatory alternatives provided by her inside-outside observations included an elaborate hoax—an external conspiracy to deceive her into thinking there was such a secret organization—and a paranoia that merely imagined such a conspiracy. Now they have come down to a simpler conjugate: either "a true paranoia, or a real Tristero."

Paranoia has a deep affinity with all that we mean by plot, which explains their commingled supremacy in melodrama. Paranoia is the hyperform of the compulsion to make sense of the facts and fragments of our experience. Its bent is negentropic; its enemy

is the tide of mere randomness that it seeks to stem, and as such it is a constant presence in Pynchon's universe. It is creative and, metaphorically at least, an element in his self-awareness as an artist. Its creativity can alter the reality it acts upon, bringing its own constructions to life, destroying or distorting the status quo ante. Delusions, if that is what they are, have consequences. Moreover, the security of the clear line between paranoia and deductive analysis warranted by the facts, as in the laboratory and the novel of detection, is shaken when all turn out to entail the participation of the observer in a relativized observational situation.

The alternative that Oedipa finds impossible to accept is the one where the observer has no role, can make no difference: "just America," with no further meaning, not even a forlorn hope of the kind implied by the Tristero's aloof readiness for "another set of possibilities to replace those that had conditioned the land" or at the very least "for a symmetry of choices to break down, to go skew." Oedipa's vision of an entropic regime is a spiritual wasteland driving toward an asymptotic  $\Delta t$ , like the fraction of her dead lover "that couldn't come out even, would carry forever beyond any decimal place she might name" in his need to possess, alter the land, divide and stir. It heads toward an America with no room for true diversity, which cuts out and leaves out what it can't assimilate and homogenize, whose model is the eminently logical "matrices of a great digital computer, the zeroes and the ones twinned above, hanging like balanced mobiles right and left, ahead, thick, maybe endless." Its logic is the binary logic of exclusion, where there is nothing between is and is not. "She had heard all about excluded middles; they were bad shit, to be avoided; and how had it ever happened here, with the chances once so good for diversity?" The alternative is the complementarity that in a sense is all middle, an opening rather than a closing off in what passes for the end of the story, and a prospect where the observer is a partner in the creation of the scene.<sup>111</sup>

The unpleasant taste to entropic finality, or thermodynamic equilibrium, as the shape of chaos, evoked an atavistic antidote. The Romantic legacy that privileged anarchic energy and that identified it with release from an oppressive order carried forward as a dialogue with entropic stagnation, particularly where the politics were pertinent. In the new Soviet state, for example, Yevgeny Zamyatin constructed his proto-Orwellian, Wells-conscious novel *We* (written 1920), in which a thermodynamic account of cosmic processes is brought to bear on social and psychological structures in an extended human perspective.<sup>112</sup> The essential conflict in this dystopian projection is between the notion of a benign, hermetically sealed, sedentary order and its disruption by an energy that will not be contained, between a clockwork society that provides a regulated happiness for all—resting on a final revolution that has ended the dialectic of history—and a continuing impulse toward freedom, passion, difference, unreason, "the square root of  $-1$ ." In the musical-mathematical metaphor Zamyatin sometimes favors, it is the difference between the spirit of homophonic integration or perfect consonance and a polyphony that accepts dissonance. The disturbing woman who speaks for revolution puts it this way to the clueless mathematician and rocket builder she seduces: "Look: there are two forces in the world—entropy and energy. The first leads to beatific quietism, to happy equilibrium; the other to the destruction of equilibrium, to excruciatingly perpetual motion" (entry 28). When her interlocutor protests against the idea



of further revolutions in an equable universe, she cries: "There it is, that very same entropy—psychological entropy. To you, a mathematician— isn't it clear to you that it is only in differences—differences!—in temperature, only in thermal contrasts, that life lies?" (entry 30). The speaker, I-330, argues for an open rather than a closed (and enclosed) society and universe, for the natural over the rational, and against a final anything. To the protagonist and chronicler, D-503, she points out that there is no such thing as a final number in the number series. The issue for D-503 and for the society of the One State lies not just in sameness and difference but in differences within the meaning of "identity," between being one and one of, an I and an item, or, more radically, between the suppression of self in programmed satisfaction (eventually through the extirpation of imagination) and its mirror inversion, the dissolving of social identity in the larger, darker, deeper universe of unconditioned energies and passions. For the protagonist, losing his bearings and his certitudes through sexual passion, as for the society erupting in revolutionary demolition, dissolution may be not terminal but a point of departure, a new beginning, because the geometrical point, should it start to move, has the most unconditioned possibilities.

The name of the secret party of revolution, the Mephi (as in Mephisto), recalls not just the Romantic rewriting of Milton's Satan—recently given voice in Wells's *The Undying Fire*—but also the efforts of Maxwell's demon to create a thermodynamic difference where none is apparent and so reduce a system's entropy.<sup>113</sup> The Mephi set out to subvert the great synthesizing project of the One State, the launching of the rocket "Integral" (a serendipitous verbal anticipation of the space-age Soyuz, signifying "Union," "Unity"), whose mission is to begin the integration of other worlds in the scheme of mathematically infallible happiness. The ultimate goal is "the endless equalization of all Creation," to integrate the universal equation, to "unbend the wild curve, to straighten it out to a tangent—to a straight line!" (entry 1). The end of the story is a revolt that begins on the Day of Unanimity and leads to the apocalyptic shattering of the containing-excluding Green Wall. But the Mephi's hapless plot to seize the Integral fails, and word has it that the disorder has been contained or rather held at bay. Yet, despite those setbacks, along with the mental castration of the narrator and the martyrdom of I-330 (which, conveyed in the narrator's lobotomized language, darken the novel's conclusion), the struggle between the chaos of energy (that is, life) and the chaos of terminal entropy is not resolved, which is the point.

Zamyatin, who had written a biography of Julius von Mayer, one of the founding fathers of thermodynamic theory, discerned in the paradoxical relation between entropy and order a focusing metaphor as well as a living reality. In an essay published after it became clear that *We* would not see print in the new Soviet milieu, "On Literature, Revolution, Entropy, and Other Matters," he restates the root idea of the novel, including the principle of inexhaustible revolution as a law of the universe, "like the laws of the conservation of energy and the dissipation of energy (entropy)."<sup>114</sup> He makes revolution, not conservation, the dialectical antagonist of entropy and makes a case for the heretical and the anarchic, the patently disruptive and apparently inimical, notably in literature: "But harmful literature is more useful than useful literature, for it is antientropic, it is a means of combatting calcification, sclerosis, crust, moss, quiescence" (108). Against the cosmic inevitabilities of

entropic decay, he invokes post-Newtonian recensions, such as the openings provided by particle physics, Einsteinian relativity, and the mathematics of Lobachevsky into non-Euclidean universes where equations using “irrationals” like the square root of minus one must have corresponding curves and solids (cf. *We*, entry 18). Even within the limits of classic thermodynamics, he can invoke the hypothetical instance, rooted in speculative scenarios going back to Kant of two dead stars colliding to “light a new star” (107). He makes the case for an art that is realer than realism, sounding much like that of the Futurists and Supremacists, an art that transcends “the fixed, plane coordinates of Euclid’s world,” which are “a convention, an abstraction, an unreality.... Far closer to reality is projection along speeding, curved surfaces—as in the new mathematics and the new art. Realism that is not primitive, not realia but realiora, consists in displacement, distortion, curvature, nonobjectivity” (112). Finally, Zamyatin understands the paradox of the observational situation, which releases the revolutionary, antientropic principle from the category of blind forces and connects it to the realm of consciousness. He scorns not only those “weak-nerved minds” that “insist on a finite universe, a last number,” and a final truth but those who “lack the strength to include themselves in the dialectic syllogism...the very thing that Einstein succeeded in doing: he managed to remember that he, Einstein observing motion with a watch in hand, was also moving; he succeeded in looking at the movement of the earth from outside” (110–111).

More than half a century after Zamyatin’s *We* (and still fourteen years before its first publication in the Soviet Union), two notable collaborators in the realm of Russian science fiction, the brothers Strugatsky, recast the roles of entropy and its negentropic opposite in a more cautious Aesopian tale, but one that also gave a dynamic role to the human observer-agent. A story of scientists in the contemporary Brezhnev era—the era of stagnation—who are mysteriously harassed and blocked in their work, *A Billion Years to the End of the World* (1974) develops a cosmic rationale for such a braking force on intellectual endeavor.<sup>115</sup> The principle at work, in the view of the most accomplished (and irreducible) of the scientists, is that of the “Homeostatic Universe,” a law of the conservation of structure subsuming that of energy and of matter. Homeostasis, the conservation of structure, is achieved through a compensatory mechanism balancing the law of “nondecreasing entropy” against the constant activity (also a law) of the rational mind.

If only the law of nondecreasing entropy existed, the structure of the universe would disappear and chaos would reign. But on the other hand if only a constantly self-perfecting and all-powerful intelligence prevailed, the structure of the universe based on homeostasis would also be disrupted. This, of course, did not mean that the universe would become better or worse—merely different—contrary to the principle of homeostasis.

(103)

It is not hard to find a political implication in the notion of a quasi-mindless self-preserving reflex in the status quo, operating to limit and annul the most innovative work of this seemingly random collection of scientists and intellectuals. The protagonist, whose excerpted memoir supplies the narrative, is an astrophysicist working on a new conception of interstellar space and the behavior of matter near certain “bubbles” or “holes”—“M-cavities.” He collapses finally when a telegram hints at harm to his child. The one scientist

who does not fold, the theorist of the homeostatic universe, becomes the repository of the unfinished work of the others. Withdrawing to obscurity, he suggests the only way forward: scientific, or perhaps metascientific. If the Homeostatic Principle is a law of nature, in this case inhibiting the advance of knowledge, it is stupid to fight it but shameful, and in the long run stupid, to give up before it. It too can be the subject of inquiry. "The laws of nature must be studied and then put to use. That's the only possible approach. And that's what I plan to do" (140). It is the position of someone who is at once inside and outside, subject to "pressure" but able to affect the equation by carrying science to the next plane. To include the "law" that reflexively limits science in science's purview is both to enlarge and to manipulate the observational situation. And with that possibility in one's sights, the end can be deferred, perhaps indefinitely, whether conceived as a neo-Newtonian balance of forces or as that other homeostasis, the terminal featureless chaos of entropic decay. "There's no hurry, he was saying. There's still a billion years to the end of the world" (142).

## BECKETT AND THE SHAPE OF CHAOS

It has been Samuel Beckett's achievement to give fullest imaginative form to the chaos of entropy while pursuing an aesthetic of parsimony, making the most of the least. It is in his plays that the lineaments of entropy are etched most clearly, starting with the most richly stated of them all, *Waiting for Godot* (1952). In these plays, the paradox in terminal entropy, uniting law and disorder, chaos and the approach to a final order, finds the means of enactment in a range of memorable images and shaped orchestrations. That such has been his achievement is plain enough to have inspired the very titles of a number of books on his work: the pithiest, *The Shape of Chaos*; the most judicious, *Accommodating the Chaos*; the one giving the direction of time (or entropy) its due, *Journey to Chaos*.<sup>116</sup> All to a degree echo a pronouncement made in passing by the artist himself—one that furnishes the epigraph to this chapter—on the task of finding "a form that accommodates the mess," that "admits the chaos and does not try to say that the chaos is really something else." By the date of these reflections (1961), *Waiting for Godot*, *Endgame*, and *Krapp's Last Tape* had been staged, three plays wherein Beckett had found such a form, not in fact separate from the chaos, or reducing it, but where the form and the chaos so entirely "accommodate" each other that they are as one.

From *Godot*, one can trace a progressive paring down in Beckett's dramaturgy, a sort of experimental titration to see what one can do without, like working through a game of pick-up-sticks. A project in "lessness" (the title of one of Beckett's prose pieces), it culminates—but doesn't end—twenty years after *Godot*, in the speaking mouth and helpless auditor of *Not I* (1972) or, in another key, in Beckett's self-parody, *Breath* (1969)—a play thirty seconds long whose elements are a pile of rubbish, a breathing sound, and a cry. Between *Godot* and *Not I* were plays whose overall direction is a progressive reduction in both means and animation: first *Endgame* (1955–1956), shorter than *Godot*, which was in two acts with two pairs of characters (plus a messenger), one pair in motion, one in place. *Endgame* is in one concentrated act, with one character in the lead pair blind and nearly

immobilized (confined to a wheelchair, he can't get up), another still moving jerkily (but he can't sit down), and a lesser pair wholly immobilized. Krapp's Last Tape (1958) has only one character (responding to his audiotaped earlier selves), sporadically mobile but largely confined to a contracted circle of light. All That Fall (1956), slightly earlier, is a radio play, "written to come out of the dark."<sup>117</sup> It is a play with the visual dimension removed, its two principal characters (one blind, the other encumbered) moving linearly, by fits and starts, against the reversible track of the soundscape, toward a standstill. At about the same time, Beckett wrote his two brief mimes, Act Without Words I and II, in a medium not blind but dumb. Happy Days (1960–1962), almost a monologue, has one fixed pair and a mound, the woman buried nearly to her breasts in the first act, up to her neck in the second, under a blazing light. Play (1962–1963) has three grey urns from which protrude the worn heads of three persons, wholly immobile and entirely unaware of one another, subject to an inquisitorial spotlight forcing memory. The second segment is a complete da capo of the first ("Repeat play exactly" says the stage direction), followed by a closing repeat (a da capo al fine), which is actually a beginning again. All these plays follow a contour of diminishing returns toward an ending, a completion, that is endlessly deferred.

Beckett once let on to spending time perusing "a kindergarten manual of science: 'L'air est partout.' 'Le plomb est un métal lourd et tendre.'"<sup>118</sup> But his school friends report he was dreadful at chemistry and physics and at war with his science teacher, though much better at mathematics.<sup>119</sup> And in fact mathematical models, in their clarity and abstraction, readily suggest themselves when one attempts to describe the shape and organization of his plays—models mathematical and musical, that ancient partnership. They abound, for example, in the structure of recurrence that Beckett so favors. More than twenty years before Godot, Beckett had written, in his substantial essay on Proust, of "the beautiful convention of the 'da capo' as a testimony to the intimate and ineffable nature of an art [music] that is perfectly intelligible and perfectly inexplicable"—echoing Schopenhauer's pronouncement that it is through the inexpressible interiority of music, "so wholly understandable and yet so inexplicable...that the motions of our innermost being are restored to us."<sup>120</sup> Beckett's repetitions, however, even in the instance of Play and its uncompromising stage direction, all follow in diminuendo, like a repeating decimal that gets less as it gets more, that can go on repeating itself, its increments getting closer and closer to nothing, forever. They plot the approach to an asymptote, like a hyperbolic curve or one of Zeno's paradoxes of motion whereby Achilles can never catch up to the tortoise if the tortoise has a head start. In an illuminating letter from Beckett to the producer, George Devine, on the rehearsals of Play in Paris, Beckett wrote, of the repeat: "According to the text it is rigorously identical with the first statement. We now think it would be dramatically more effective to have it express a slight weakening, both of question and of response, by means of less and perhaps slower light and correspondingly less volume and speed of voice." Beckett's interest, he wrote, was in reinforcing "the impression of falling off which this would give, with suggestion of conceivable dark and silence in the end, or of an indefinite approximating towards it."<sup>121</sup>

In the end, there is more than mathematics and music in the weave. In a notice of Beckett's *Worstward Ho* (1983), the brilliant expositor of modernist literature Hugh Kenner flirts with the relevance of Heisenberg's indeterminacy but concludes: "Heisenberg? No,



Beckett's is an older cosmos than Heisenberg's: a cosmos doomed by entropy, by the heat death identified with the 19th century, the obliteration of difference, the cessation of meaning (which derives from difference). That was still a gripping doom when Beckett was a schoolboy. All doings would subside into a tepid soup."<sup>122</sup>

If one accepts the premise that absolute disorder, terminal disorder, is unimaginable, then one must recognize that the featureless order that is the ideal last term of an entropic chaos is especially, if dissemblingly, rebarbative, engaging the mind's resistance to both absolute disorder and absolute order. And in Beckett's imaginative world, it is unattainable. Representation then, here as elsewhere, entails strategic indirections and exploitation of the medium itself, with its ingrained habits and expectations. In such circumstances, the simplest way to evoke the chaotic condition would be a systematic violation of all cognitive and aesthetic expectations—as in the anarchic enactments of Dada. Beckett's exploitation of the dramatic medium to evoke a specifically entropic chaos is not that straightforward. Characteristically, he finds in the medium accommodation for a chaos that happens by the numbers, framed as an inexorable law of change, a chaos that locks qualitative loss to the direction of time but embeds ultimate deferral of the end state in the process of getting there.

There is an affinity between "plotting" the approach of a hyperbolic curve to an asymptote—that is, representing it diagrammatically, as the dictionary has it—and plotting "the arrangement of the incidents" and "the structure of the incidents"<sup>123</sup> along the path of the action. Plot would seem to suffer a check in *Waiting for Godot*, for if plot is a function of the path of the action, what does it look like when the action is *Waiting*? What is the trajectory when the action goes nowhere? When the logic of events, the impelling motivation, is to pass the time? What in that case is the structure of waiting, of passing the time?

What structures waiting is, first, duration, and, second, sameness and difference, that fundamental pair, and underlying all, the direction of time, which here plots a reduction in difference as well as a progress in lessness. Sameness and difference are, in the final analysis, fundamental to all art but are especially to the fore in the nakedness of music. The *Grove's Dictionary* contemporary with *Waiting for Godot* addresses the matter of musical form in such terms:

Every attribute of music, relationships of pitched rhythm in succession (melody) and concurrently (polyphony and harmony) plays its part in establishing the form of a musical work by creating a series of identities and differences which the ear can recognize. As long as musical sound consists solely of repetition, the monotone, it remains formless. On the other hand, when music goes to the other extreme and refuses to revert to any point, either rhythmic, melodic, or harmonic, which recollection can identify, it is equally formless. Repetition and contrast, therefore, are the two twin principles of musical form.<sup>124</sup>

Beckett, in a director's notebook for *Happy Days*, analyzes the play under the twin rubrics "Repetition Texts" and "Variation Texts"—variation uniting recurrence and difference.<sup>125</sup> The monotone in all these plays is interminably approached, and—even in the near-dead world of *Endgame*—interminably deferred. For the approach, through the diminution of difference in repetition, in a serial, reiterated scaling down, is no less than the direction of time.

Duality, the numerical condition that frames sameness and difference—duality doubled—

inheres in the very subtitle of *Waiting for Godot*, at least in Beckett's English version: *A Tragicomedy in Two Acts*. And duality ostentatiously governs the play: two acts, two pairs of characters, two identical messengers, allegedly brothers, two modes of existence, one nearly static and the other in stumbling motion. Only one of the pairs waits: Vladimir and Estragon. Didi and Gogo for short (repeating dissyllabics), they are complementary in their pairing (one is given to reflection, the other to present sensation; one has stinking breath, the other stinking feet). Their common condition is essentially stasis. At the end of each act, one says to the other, "Well? Shall we go?" "Yes, let's go." And the stage direction observes, "They do not move." The phrase with which one of them opens the play recurs regularly with variations: "Nothing to be done." The second act begins with the direction, "Next day. Same time. Same place," and it repeats the first act in form and substance, with variations in detail. Both the opening and conclusion of the play imply prior and subsequent repetitions, serial recurrence without completion. But there is a direction, even if Gogo and Didi are not going or getting anywhere. The second act repeats the first, but it is about one-sixth shorter. It opens with one of those endless repeating songs like "The Bear Went Over the Mountain," except that this song, about a cook and a dog and the dog's tombstone, is supposed to be written upon and read from the tombstone, making for an infinite recession and, as it were, an infinite diminuendo. Things lessen.

This stasis of interminable waiting is intersected by motion. Once in each act, the other pair, Pozzo and Lucky, master and slave, cross the stage, pausing for a while to socialize. They are in motion and manifestly subject to time, time as measured by motion. Pozzo ostentatiously consults his pocket watch and has a schedule. They have a direction and so, it appears, are subject to measurable decline. From act 1 to act 2, they suffer a steep fall. But even in the first act, entropy seems visibly at work, in Pozzo's progressive loss of props and appliances: pipe, watch, atomizer. Lucky, ex-poet and slave, is commanded to think, and the subject of his unfinished and unstoppable tirade is the temporal condition, as manifest, notably, in the science of "Anthropopopometry," whereby it appears that—on a dying Earth—man "wastes and pines, wastes and pines and...for reasons unknown but time will tell fades away...and then the earth in the great cold the great dark the air and the earth abode of stones...the skull fading fading fading."<sup>126</sup>

The human subject of Lucky's science of anthropopopometry is present under two aspects in the two couples, each pair, as the play jokingly suggests, standing for "all humanity," like Cain and Abel, Adam and Eve. The two aspects are, in the language of the subtitle, tragedy and comedy. The comic in its foundations is precariously static; whatever happens, nothing really happens. Tom never eats Jerry, and when Wyle E. Coyote is reduced to two dimensions by the steamroller, he springs right back. Gogo and Didi, marking time, go through their *commedia dell'arte*, Marx Brothers routines and suffer comically (everyone cheers Didi in his urological agony off stage). Theirs is the slow catastrophe of sustained farce. Estragon paraphrases Heraclitus's metaphor of the river: "Everything oozes...It's never the same pus from one second to the next" (f. 39). Things may change as by seasonal variation (the tree that is almost the single feature in the landscape puts out a few leaves between act 1 and act 2). But essentially the two clochards and the condition of their waiting remain the same.

With Pozzo and Lucky, it is a different matter. Lucky's suffering is not so easy to laugh off. Their dependency is different from that of the domestic partnership of Gogo and Didi. It is the relation of master and slave, and in that gravitational disequilibrium there is the potential for dynamic change. Pozzo, who claims to be among the mighty of the earth, who offers his audiences the image of a Tamburlane driving his conquered kings, has gravitational energy to expend. He falls in a steep trajectory from act 1 to act 2, like Oedipus into blindness, taking Lucky with him into silence, and the two of them wind up leveled to the boards, tangled and helpless among their scattered luggage.

The two aspects, tragic and comic, are encapsulated in an image of human life that goes back at least through the Venerable Bede, a version of which is propounded by Pozzo—who is haunted by time—and is then ruminated by Vladimir. Lucky is now dumb; Vladimir, astonished, asks, since when? Pozzo, furious, cries out, "Have you not done tormenting me with your accursed time!...When! When! One day, is that not enough for you, one day like any other day...They give birth astride of a grave, the light gleams an instant, then it's night once more. (He jerks the rope.) On!"<sup>127</sup> Where nothing is fixed but the direction of change, past and future are telescoped, the present is annihilated in sheer velocity, and the only impossible action is inaction, immobility. But then Vladimir ruminates: "Astride of a grave and a difficult birth. Down in the hole, lingeringly, the grave-digger puts on the forceps. We have time to grow old. The air is full of our cries. (He listens.)" (ff. 57–58). Where the past is only an unreliable memory, where the future is a blank, only the present is real—and interminable, and the only possible action is waiting.

I think we have now left the thermodynamics of the nineteenth century, after all, for a plotted version of the principle of indeterminacy, where you can locate a particle precisely either according to its motion or according to its position, one or the other. Here then are two takes on "How It Is" (another Beckett title), which cannot be fully reconciled except as paradoxical complementarities: two experiences of time and change, united in a single quantum subject—namely us. But perhaps one doesn't have to leave the nineteenth century for such complementarity relative to the experiencing subject. Schopenhauer, one of the philosophers Beckett read carefully, had long since observed, "There is no greater contrast than that between the irresistible flight of time, which carries with it its entire content, and the rigid immobility of the actually existing which remains one and the same at all times,"<sup>128</sup> an existential prologue to ultimate union in a featureless duration that had become the promised (if never quite unattainable) end, an appropriate modern symbol of the chaos that is both trajectory and condition.

In the end Gogo and Didi remain, and it is the plot in its comic aspect—the waiting, the boredom, the stasis made entertaining by actors desperate to pass the time—that is more memorable and perhaps more terrible. It is the acid test for any dignity that the indignities of life allow. Gogo and Didi are in effect perpetually stood up, which is to be placed in a thoroughly undignified position, one in which the only relief—laughing at oneself—is bound to be painful. But there is some tincture of pathetic honor in the situation for the species, and even a note of qualified superiority. As Vladimir says in his most ill-timed rhetorical flight (f. 51), "we have kept our appointment. How many people can boast as much?" And Estragon replies: "Billions."

Endgame—whose opening words are the progressively weakening assertion, “Finished, it’s finished, nearly finished, it must be nearly finished”—resumes the asymptotic approach to finality when “it” (or everything) appears almost at the last gasp. The speaker, Clov—the stiffly mobile servant of the blind and chair-bound Hamm—goes on to allude to the ancient conundrum on when and how quantitative accretion makes a qualitative change: “Grain upon grain, one by one, and one day, suddenly, there’s a heap, a little heap, the impossible heap.”<sup>129</sup> The end, as in the title, has been announced, yet despite the numerous irreversible terminations, depletions, and discards that follow and Hamm’s delphic “time was never and time is over, reckoning closed and story ended” an hour later (83), the end remains inconclusive. The curtain falls on a final tableau with Clov poised to leave, and unleaving, Hamm shrouded in his handkerchief, but undead.

There is some evidence that Beckett began his play with the wasteland landscapes of the Great War in mind,<sup>130</sup> and it took shape in the shadow of Cold War thermonuclear test explosions and projections of nuclear winter. Vestiges of such specificity remain in the converted blockhouse/shelter<sup>131</sup> and the reported view of earth and sea, but they are only vestiges, and what the play makes concrete, after undergoing what Beckett once called “vaguening,”<sup>132</sup> is the shape of an endgame, postcatastrophic and nonspecific in its etiology, where the losses are incremental and additive (or subtractive). There is an ever-growing list of the things that have run out: no more bicycle wheels, no more pap, no more sugar plums, no more tides, no more rugs, no more painkillers, no more coffins.

**CLOV:** There’s no more nature.

**HAMM:** No more nature! You exaggerate.

**CLOV:** In the vicinity.

(11)

Nagg and Nell, Hamm’s legless parents, make what is probably their final appearances from their ashcan containers. Clov, looking out through his telescope, notes, startled, that the light has sunk (until recently, “There was a bit left”). He reports that the waves are “lead,” the sun is “zero,” there is nothing on the horizon, and neither night nor day. Instead, all is “Gray.... Gray!...GRRAY! . . . Light black. From pole to pole.” The world, in a word, is “corpsed,” on the way to Clov’s dream of order: “A world where all would be silent and still and each thing in its last place, under the last dust.” Toward that final state, “Something is taking its course” (30–32, 57).

There are sporadic countercurrents: a flea or crab louse that has to be exterminated lest from it humanity start all over again, a rat that escapes only half dead, and the reported appearance outside the shelter of a small boy. His appearance recalls a narrative, ostensibly literary, that Hamm works at sporadically and leaves inconclusive, a narrative suspiciously open to being construed as an account of Hamm’s acquisition of Clov. It raises the possibility of recurrence, perhaps with Clov replacing Hamm in line with Hamm’s prophecy (“One day you’ll be blind like me”). But if such were to be the sequel, it would not constitute a reversal of the entropic flow but merely the next term in a diminishing series or (shifting attention from the top to the bottom of the hourglass, as in quantifying entropy) one more grain of sand added to the heap on the way to (in Krapp’s memorable phrase) the



unattainable laxation.

## SIGHTS AND SOUNDS

Beckett's reductionist program was not without significant analogues in the art and music of the twentieth century. Giacometti, whose bedrock pessimism fueled their friendship, was no less devoted than Beckett to an art of subtraction (he supplied the schematic tree that marks the place of waiting in the first Paris revival of *Waiting for Godot*, Odéon, 1961). But the pursuit of a proximate finality through drastically reduced means, a "vaguened" contextuality, an attenuation of difference, served as a strange attractor for a whole array of artists and composers pushing "the limit of almost."<sup>133</sup> Malevich, Rauschenberg, Reinhardt, Rothko, all at some stage reached toward such a featureless finality emerging from the chaos. In music, where one pole of the chaotic is conveniently rendered by whatever happens to be thought of as noise, the other pole—the one that takes on the imputed qualities of entropic order—wears various faces, from the measured blank of John Cage's *4'33"* (1952), "performable" by any instruments (and where the music may also be thought of as the restless stirrings of the audience and the random sounds from outside that fill the silence), to the new formalism of Arnold Schoenberg. In the music that emerged from Schoenberg's revolution, equalization of tones, erasure of difference between consonance and dissonance, and the directional logic in permutative serial recurrence variously suggest entropic processes analogous to the quelling of thermodynamic difference and the reduction of hierarchical organization. A letter from the painter Franz Marc on a concert he attended with Wassily Kandinsky and other painters—a first performance of the music that broke through to atonality—suggests some of these aspects. It also makes vivid how schemata emerging from the conceptual leanings and new departures of the age can leap between the arts and, in the modern period, give analogous concrete expression to whatever makes problematic received reality:

Can you imagine a music in which tonality (that is, the adherence to any key) is completely suspended? I was constantly reminded of Kandinsky's large *Composition*, which also permits no trace of tonality...and also of Kandinsky's "jumping spots" [springende Flecken] in hearing this music, which allows each tone sounded to stand on its own (a kind of white canvas between the spots of color!). Schoenberg proceeds from the principle that the concepts of consonance and dissonance do not exist at all. A so-called dissonance is only a more remote consonance—an idea which now occupies me constantly while painting.<sup>134</sup>

Eventually the Brownian motion (or foretaste of op art?) that Marc, via Kandinsky, hears in Schoenberg's undoing of tonality resolved into the systematics of serialism. A perceptive commentator on Beckett's affinities with the music of that school, however, constructs a proportional equation:

Joyce: Beckett = Schoenberg: Webern

—a comparison resting on the difference between Schoenberg's appetite for "messianic reanimation of large-scale musical forms" and Webern's "scrupulous reductionism."<sup>135</sup> Beckett's "serialism," most marked in the short pieces of his later decades (e.g., *Not I* or

Come and Go) was of the Webern kind, its motivic elements in combinatorial recurrence held within drastically reduced parameters and exhausting their logic in brief compass. Beckett's rule-governed serialism was never mathematically strict, however. Variation and recurrence are subordinate to shape, as in establishing the track of a diminuendo al niente,<sup>136</sup> while motivic returns, in *Godot* and thereafter, incorporate an element of randomness and local unpredictability.<sup>137</sup> Left on their own, they might have emerged as the unfiltered, unrectified aleatory processes of John Cage's seemingly opposite approach to realizing the chaos. Beckett in fact produced the classic send-up of programmed serialism in his novel *Molloy* (1951), in "the deadpan distribution of the sucking stones," a "poker-faced parody of serial technique," as the critic making the best case for Beckett's affinities with musical serialism acknowledges.<sup>138</sup> And as parody, intercut segments from that same obsessively enumerative, serially exhaustive passage from *Molloy* are deployed to devastating effect by Rosalind Krauss, in her classic deflation of the historical pretensions foisted upon conceptual and minimalist art, with Sol LeWitt's 122 Variations of Incomplete Open Cubes directly in her sights.<sup>139</sup>

Nevertheless, what constitutes a cheerful program for breaching the membrane dividing art and experience in Cage the anarchist is still embedded in a rigorous strategy for giving symbolic form to the dubious content of that experience in Beckett the reductionist. The irreducible distance between them is manifest in their approach to performance. Beckett, though willing to modify text and choreography in productions where he was directly in charge, notoriously invested absolute authority in the script. Cage on the other hand moved from incorporating chance and the unpredictable in the process of composition to incorporating them in the actuality of performance. Having begun composing using intricate numerical patterns to give structure to his music, he eventually "developed complex and beautiful graphic notations...requiring performers to make choices on every level from small detail to big structure and guaranteeing that no two performances will ever be alike and that each new realization would be unforeseen by the composer himself."<sup>140</sup>

The chaos one prefers, like the strategy of its representation, is no doubt rooted in temperament or metabolism, much as in the contrast Beckett draws between the two mimes whose facing up to life constitutes the compressed action of *Act Without Words II*. It is hard to imagine Beckett, the European stoic comedian and ironist, urging an affirmative embrace of the besetting chaos in anything like the Whitmanesque spirit with which Cage, hearty American romantic, answers his own Gauguinist questions, "Where are we going? And what are we doing?" Cage's introduction to the published form of the polyvocal lecture of that title concludes, "Here we are. Let us say Yes to our presence together in Chaos."<sup>141</sup> But when Winnie in *Happy Days* greets another wonderful day, her expressions of affirmative cheerfulness are ultimately heart-wrenching in their incongruence, serving about as well as the umbrella that catches fire in the blazing light to shield her from the glaring reality; Krapp can only snort at his earlier pompous resolve to embrace the chaos in all its negativity; and Hamm and Clov, whose bond is anything but that of love, are panicked at the thought of the whole chaotic mess starting up again.

## CODA, OR DA CAPO AL FINE

Science is a match that man has just got alight. He thought he was in a room—in moments of devotion, a temple—and that his light would be reflected from and display walls inscribed with wonderful secrets and pillars carved with philosophical systems wrought into harmony. It is a curious sensation, now that the preliminary splutter is over and the flame burns up clear, to see his hands lit and just a glimpse of himself and the patch he stands on visible, and around him, in place of all that human comfort and beauty he anticipated—darkness still.

—H. G. Wells (1891)

**A**s a gesture, the blank page, the all-white or all-black canvas, the performance of silence, is something of a dead end. Made once with effect, it is unrepeatable except as it manages to fail of its ostensible finality. Otherwise, the gesture can be made again when sufficiently distanced or forgotten, or when the contexts that gave it meaning have, or seem to have, sufficiently changed. Such would appear to be the case following the thirty or forty years that separated the heyday of Reinhardt, Rothko, and Rauschenberg from that of Malevich and his generation. Of that earlier twentieth-century outburst, a historian of the arts could write:

In 1913 the poet Vasilisk Gnedov, who called himself an “Ego-Futurist,” wrote what he called “The Poem of the End”—a blank page; in 1917 Malevich began his series of “white on white” paintings; also in 1913 Kruchenykh introduced a “transrational” language—expressed in his poem called “Heights”—consisting only of vowel sounds; in 1918 Alexander Rodchenko painted his three minimalist canvases of pure red, yellow, and black; and in 1920 the Russian Dadaists, who actually called themselves “Nothingists” (since the Russian “da, da” was too affirmative), paraphrased Tristan Tzara’s manifesto by declaring “Read nothing, write nothing, publish nothing.”<sup>1</sup>

If three or four decades later Malevich’s Black Square (or Quadrilateral) of 1915 no longer said it all, it was because the contexts that give imputed meaning had shifted. The argument in painting had moved on, and the contested ground had been redefined in the heroics of modernist practice. But also the ambient climate was much changed between the era of revolutionary modernist challenge in Russia and that of post-traumatic displacement and Cold War anxiety in the years following the Second World War.

In pursuing the subject of this book, it would never do to suggest that the necessary indirection that conditions the representation of chaos could produce an unequivocal symbolic language, so that the black square representing the primal chaos—the chaos of Nothing—in Robert Fludd’s *Utriusque Cosmi*, the Black Square that Malevich made the centerpiece of “The Last Futurist Exhibition,” or the black oblongs that Rauschenberg pasted in 1951 spoke the same language and meant the same thing. Consequently, the all-black or all-blank canvas, or the field of fading grays, should not be assumed to engage the imagination or the feeling of, for example, entropic chaos without some confirming clue to intention or response. Fortunately, where the work of art refuses to explain itself—as most notably in the art classed as abstract or nonobjective—the artist often seems impelled to

compensate. Certainly the twentieth century has been distinguished by a host of explanatory artists—explanatory of their philosophical premises, of the phenomenology of the medium that is the metacontent of their work, of the transcendent character of the image or the idea. Titles have always been a means, in art, of putting spin on the purity of the image. But even where that gambit is fastidiously declined—as in the myriad canvases titled “Untitled”—other language is liable to shape response, attach content, open the work to interpretation. Malevich, however, is especially difficult to pin down. In both the rhetoric of romantic subjectivism and the case for autotelic art in his Supremacist rationales, where he sees consciousness imposing its “lawfulness” on the disorderly activity of the natural world, there is an engagement with a condition of chaos. He even gives hints of an entropic chaos, “an environment in which everything collapses without resistance” and where, in the end, art “reaches ‘a desert’ in which nothing can be perceived but [human] feeling.” So, in the particular instance of his black square on a white field, what is to be perceived is feeling (black) and void (white).<sup>2</sup> Nevertheless—the road to his pregnant black geometry having absorbed the ebullient dynamics of Russian Futurism—Malevich exudes the aggressive optimism that identifies clearing the ground of the rubbish of the past with the release of new forces; with gain, not loss; with energy, not entropy, though the energies are those of the mind and spirit.<sup>3</sup>

With Ad Reinhardt half a century later, notably in the final series of black paintings that he spoke of as “ultimate paintings,” we are in a different country. They were “ultimate” because they were so reduced in pictorial means, so subtle in variation and gradation of color, that there was almost no room for lessening. Historically, Reinhardt noted that his birth date in 1913, falling between the landmark Armory show and the outbreak of the Great War, occurred “during the year in which Kazimir Malevich painted the first geometric abstract painting.”<sup>4</sup> But far from reaffirming the significance with which Malevich informed his achievement, Reinhardt could almost be Samuel Beckett himself (his near contemporary) when he speaks of “Painting that is almost possible, almost does not exist, that is not quite known, not quite seen.”<sup>5</sup> As to the work that best fits this description, the viewer, in the account of one analyst, is left with nothing but the act of seeing and its object, and “What one then perceives, in the blackest of the ‘black’ paintings, is no longer the infinitesimal variation of color (although of course this plays a part), but the always fleeting, always dubitable, beginning, the promise of a speck of light, the ‘last vestige of brightness.’”<sup>6</sup> Even here, the reductive strategy that approaches a final point of visual depletion amid the severest reduction of difference fails of its goal, not only through a resistance to sensory deprivation produced by sustained attention—the fleeting, dubitable hint of a speck of light—but by virtue of the reiterated, scarcely visible Greek cross composed of oblong blocks that percolates through all these paintings, a form that Malevich also derived from (in his case) the generative square and made much of.<sup>7</sup>

For some who knew Mark Rothko, the Reinhardt connection was “the ghost that hovered” over the series of black and gray paintings with which he finished out the 1960s.<sup>8</sup> Moreover, it appears that these paintings were conceived at least partly in response to a commission for a room that would contain sculpture by Giacometti.<sup>9</sup> Barbara Novak and Brian O’Doherty describe their reductive eloquence:



The black on gray paintings place an enormous weight on the reduced means. A thin membrane of paint is silhouetted against a harsh marginal light, which limits and defines both the viewer's attention and the reduced repertory of means within. The dark rectangle above, usually assigned the more generous space, is unannotated and mute. The lower lighter rectangle offers fugitive and somewhat futile traces of activity.

The horizon of meeting is offered as “the main incident in these pictures,” but the meeting is matter-of-fact (fig. 8.1). The drama of the scene and the conjunction is reduced by being treated unemphatically, as “how it is.”<sup>10</sup>

In their reading, Novak and O'Doherty find an analogy for “the cartography of this bleak terrain” in Beckett's theater (277, 280), where the sense of an impinging chaos can translate into an advancing absence and darkness and the complicit fading of light and color, shape and outline, into a near extinction. But they also see the dark paintings as the most recent term in a long and distinguished intellectual tradition engaging the precincts of chaos and darkness and as the culmination of a life's pursuit. If as they suggest these “eerie proto-landscapes...can be seen as elemental night over a slightly luminous, slowly roiling wasteland” (279), then it is not only the outlook in *Endgame* that is relevant. One thing that comes to mind—apart from the monochrome graphic images of the empty wastelands of the Great War—is an inverted Caspar David Friedrich, his subdued ground and luminous, embargoed distances meeting in unemphatic horizontal division. And there is a documented anterior affinity with Turner's late Deluge paintings, *Shade and Darkness* and *Light and Color*.<sup>11</sup> There is also a measure of poignancy in such a line of descent from Turner's renderings of primal energy in “the chaos of the actual,” to the spectacle of energy transformed and depleted, confined and expressed in its last duality, two-thirds absorbed in the darkness that erases the last shadow of difference, on the way to and steadily closing in on Nothing.<sup>12</sup>

Still, if there is no unequivocal symbolic language to be read in the imagined representations of chaos and the chaotic across time and history, medium and genre, there are constants in the need, the bent, and the experience of the minds so engaged that enable their imaginings to speak across the ages. It was not for nothing that the critic Jan Kott wrote a famous, if controversial, essay called “*King Lear*, or *Endgame*” and that the director, Peter Brook, staged *King Lear* as if it were a play by that master plotter of universal entropy, Samuel Beckett.<sup>13</sup> Among the many works of the imagination that I have called upon to illustrate and explore the representation of chaos—poems, plays, novels, a film or two, paintings, prints, cartoons, architecture, music, philosophical arguments, scientific papers and commentaries—a selection from an endless field of relevant possibilities—one work in particular, I found, resisted comfortable placement in one or another of the broad sections organized around a strategic representational motif, and that was *King Lear*. That troubled me, because Shakespeare's *King Lear* is among the most powerful and complete evocations of a universe in chaos that the human imagination has managed to produce. I do touch on it here and there, but under no rubric have I offered a sustained examination like that bestowed on Sophocles' *Oedipus Tyrannus*, in “*Number*,” or Carlyle's *French Revolution*, in “*Energy*.” The problem is not that *King Lear* does not fit my imperfect categories but that it fits and subsumes them all. Nothing, for example, is a word that rings through the play, from Lear's “Nothing will come of nothing” at Cordelia's having

nothing to say, to the Fool's likening Lear's state to an empty eggshell after he has divided the kingdom and given away the meat, to the revelation of the abyss that seems to open up in the heart of men and things. NUMBER and measure enter with Lear's attempt to divide his kingdom and to quantify love, repaid with his daughters' ultimatum on reducing his train from one hundred, to fifty, to twenty-five, to "What need one?" The CARNIVAL trope of inversion and disorder was particularly prevalent in Shakespeare's time, and King Lear makes much of its chaotic reversals of wisdom and folly, king and beggar, master and servant, justice and perpetrator, blindness and sight, reason and madness, male and female, and of course parent and child. Lear, says his Fool, when he gave up his crown, "mad'st thy daughters thy mothers," "bor'st thine ass on thy back o'er the dirt," and much else in the same vein. The Carnival feature, Monstrosity, offers a name for such "unnaturalness," for the play's prodigies of evil, for such a world turned upside down, and both the word and the concept—of compound beings, animal natures in human form, demon hybrids and moral "Centaur" outside of Nature—rise up time and again.

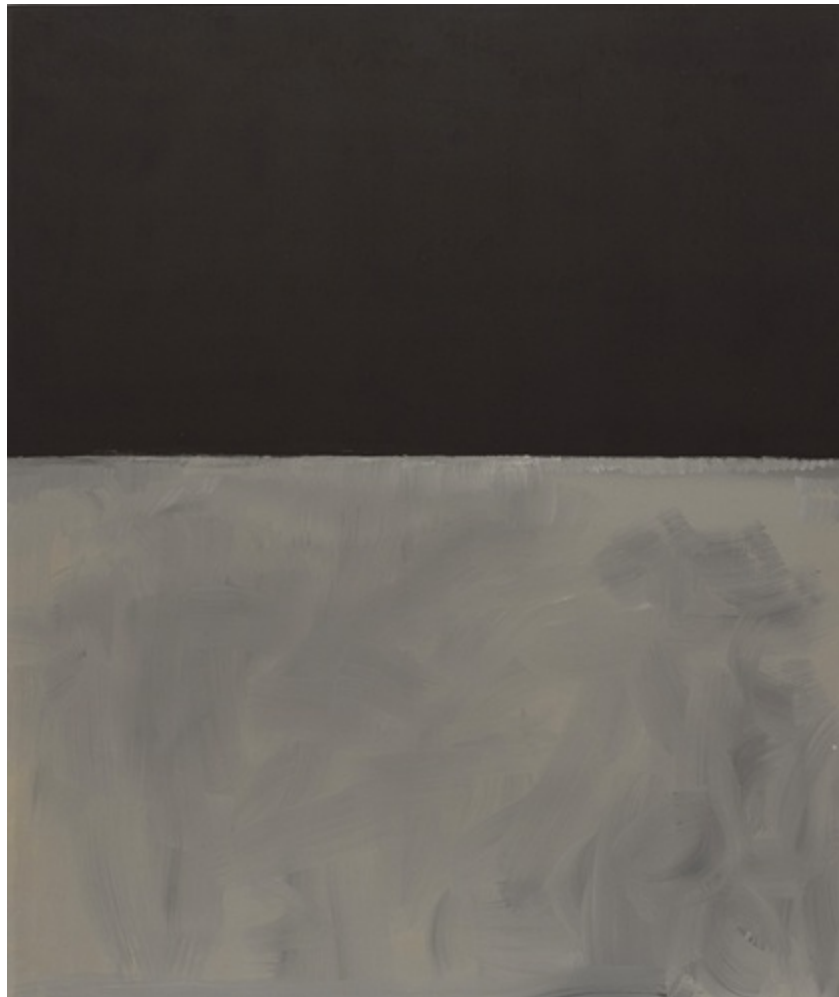


FIGURE 8.1. Mark Rothko, Untitled [Black and Grey], (1969–1970). Synthetic polymer paint on canvas.

Source: Museum of Modern Art, gift of the Mark Rothko Foundation, Inc. © Kate Rothko Prizel & Christopher Rothko / Artists Rights Society (ARS), New York. Digital Image © The Museum of Modern Art / Licensed by Scala / Art Resource, NY.

Madness, the mind in chaos, as the play's internal commentators well understand, is the echo of the disastrous fracturing in society, with both echoed in turn in Nature and the

cosmos and made manifest in the central eruption of the storm on what Ishmael will call “the blasted heath.” The storm is read as War, a war of the elements, wherein the elements join battle with man. The King is reported, and then shown,

Contending with the fretful elements;  
Bids the wind blow the earth into the sea,  
Or swell the curled waters ’bove the main,  
That things might change or cease.

(3.1.4–7)

He urges that the violence “Crack Nature’s moulds” and “Strike flat the thick rotundity o’ th’ world” (3.2.7–8). Only on the scale of universal catastrophe can Lear find an analogue for “the tempest in my mind.” Actual war gives still another face to the chaos, fratricidal in character, ruinous to the kingdom, indifferently disastrous in its consequences, and carrying division and dissolution to exhaustion. Energy in the drama is overwhelmingly a disruptive and divisive force to which the virtuous and decent mostly react; Entropy—complicit with age and mortality—describes the hyperbolic curve whereby the energy, self-consuming, bleeds out in heat and motion, leaving a devastated, shrunken world whose survivors will try to make something of the ruins. And it is this dimension, bare of any metaphysical reassurance or consolation, that seems to speak most eloquently to our time.

There are other voices that speak to us, of course, like that of Haydn bringing alive the spectral sublimity of an inchoate protouniverse, or of Richard Feynman enraptured by the beauty and the mystery of how things work “behind the scenes,” or of Benoit Mandelbrot, joining chaos and cosmos in a new geometry, making inroads into Huxley’s “regions of disorderly mystery” heretofore dismissed as noise and confusion, outside the law that constitutes cosmos, and so left in the dark.

But as Milton’s Satan, penetrating Chaos, discovers in *Paradise Lost*, even after the subtraction of Heaven, Earth, and Hell, “a dark / Illimitable Ocean without bound” still remains—like the black emptiness in Robert Fludd’s “Et sic in Infinitum” or the “blackness still” that Wells’s modern man discovers beyond the flame of his new-lit match of science in the epigraph to this final word, or the “Magnum Chaos” that surrounds the symbolic rendering of Creation in the image that accompanies the title page of this book. The Chaos remains, illimitable and so unimaginable, a perpetual challenge and an invitation, stretching endlessly between Milton’s scarred but intrepid explorer and the distant, unattainable glimmer of absolute Light.

A note on the frontispiece: The image that greets the reader, monstrous at first glance as if itself a creature of chaos, is from an intarsia designed by Lorenzo Lotto in about 1527 (and executed by Giovanni Francesco Capoferri) for the choir in the basilica of Santa Maria Maggiore in Bergamo. It was most likely the cover for a more elaborate intarsia of the creation of man and the universe. The outflung hands of Lotto's pictogram of divinity in action, an image condensing God's providential all-knowingness and power, are evoking the cosmos, on which, amid the chaos, the figure stands, rather than dividing and separating with outward thrusting palms, like the bounding Creator in Raphael's better-known Vatican loggia design (fig. 3.2). The annular structure of the cosmos already appears within the burst of light, whose regularly patterned tentacles, reaching out into the void, nevertheless convey the moment's coruscating energy. The eye as a symbol of all-seeing divinity had abundant precedent, but the bizarre figure as a whole, in its ellipses and emphases, uncannily anticipates Blake's unimaginable Creator in his Song of Experience, "The Tyger." Among the aids to deciphering Lotto's intent, I found useful Francesca Cortesi-Bosco's judicious and informative *Il coro intarsiato de Lotto e di Capoferri per Santa Maria Maggiore in Bergamo* (Bergamo: Silvana, 1987), and Diana Galis, "Concealed Wisdom: Renaissance Hieroglyphic and Lorenzo Lotto's Bergamo Intarsie," *Art Bulletin* 62 (September 1980): 363–375.

## Ω. UNCERTAINTY AND COMPLEXITY: AN UNTETHERED EPILOGUE

1. Werner Heisenberg, "Discussion with Professor Heisenberg," in *The Nature of Scientific Discovery: A Symposium Commemorating the 500th Anniversary of the Birth of Nicolaus Copernicus*, ed. Owen Gingrich (Washington: Smithsonian Institution Press, 1975), 566.
2. Laplace, as quoted in Hermann Weyl, *The Open World: Three Lectures on the Metaphysical Implications of Science* (New Haven, Conn.: Yale University Press, 1932), 34.
3. Faith comes into it as well by way of practicality. The disabling condition in Laplace's formulation of principle is the scale of the unimaginably vast sea of information that would have to enter into the calculation. The notion that the problem might be overcome by, say, a superprogram in an array of supercomputers is effectively undone on Gregory Chaitin's Omega principle (the program would have to be as large—or larger—than the universe). See Gregory Chaitin, *Meta Math! The Quest for Omega* (New York: Pantheon, 2005).
4. Richard P. Feynman, *Surely You're Joking, Mr. Feynman!*, as told to Ralph Leighton, ed. Edward Hutchings (New York: Norton, 1985), 261. Feynman is explaining his reason for wanting to learn to draw. For a critique of "The Beauty Myth," especially as an argument for the reality of such theoretical constructs as "superstrings," see Lee Smolin, *The Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next* (Boston: Houghton Mifflin, 2007).
5. See Paul Feyerabend, *Against Method: Outline of an Anarchistic Theory of Knowledge* (London: Verso, 1978), 39–41. Feyerabend, with characteristic ebullience, promotes the free play of alternative and incommensurate explanations as an antidote to the tunnel vision produced by reductive accounts of the actual world. As for Einstein's vindication of God's austere upright character, Feyerabend comments, "God not only plays dice, he also cheats" (121).
6. Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (Boston: Houghton Mifflin, 1950), 19. For St. Augustine, see chapter 1.
7. H. G. Wells, *Experiment in Autobiography* (New York: Macmillan, 1934), 178–179. Max Planck, *Where Is Science Going?*, trans. James Murphy (New York: Norton, 1932), appeared with a prologue by Albert Einstein. See also Max Planck, *Philosophy of Physics* (New York: Norton, 1936), where he reflects ruefully on the hope that the disjunctions between the ideal "world image" of classical physics and the actual world of the senses "would ultimately be rendered progressively insignificant as methods of measurement became increasingly accurate. This hope has been destroyed for good with the entry on the scene of Planck's [!] quantum" (58). The essay then offers conceptual routes, admittedly open to challenge, for rescuing the faith in determinate causality from the now more prevalent views of the "indeterminists."
8. Wells, *Experiment in Autobiography*, 172. Though impatient with his physics professors, Wells reports that in the livelier students' Debating Society he lay hold of the "idea of a four dimensional frame for a fresh apprehension of physical phenomena, which afterwards...gave me a frame for my first scientific fantasia, the Time Machine."
9. H. G. Wells, "The Rediscovery of the Unique," *Fortnightly Review* 56, n.s. 50 (July 1891): 106–107.
10. Wells, "The Rediscovery of the Unique," 111. The metaphor appears in Faust, in Mephistopheles' satirical



demonstration to the young student of the inadequacy of academic analysis and its protocols. It also appears in the “Ur-Faust,” where the Erdgeist “weaves the living garment of the deity on the whirring loom of time,” and most notably in the late poem “Antepirrhema.” See John R. Williams, *The Life of Goethe: A Critical Biography* (Oxford: Blackwell, 1998), 120.

11. Wells, *Experiment*, 177, 181–182. Unimpressed, the physicist David Helfand points out that “the identity of electrons to one another has been demonstrated to extraordinary accuracy; the identity of carbon atoms on Earth to those 90% of the way across the universe has been shown to 8 significant figures” (private communication).
12. Reprinted in Max Born, *Physics in My Generation* (London: Pergamon, 1956).
13. Max Born, “Statistical Interpretation of Quantum Mechanics,” in *Physics in My Generation*, 185–186.
14. The principal speaker in this section’s epigraph is Professor Flowerdew, an adherent of Ernst Mach’s rejection of a science based on “unobservables.” The conversation is set in the Cavendish Laboratories, Cambridge, in 1912 (Penelope Fitzgerald, *The Gate of Angels* [New York: Houghton Mifflin, 1998], 24).
15. Max Born, from the postscript to *The Restless Universe* (1951), reprinted in *Physics in My Generation*, 231.
16. John Dupré, *The Disorder of Things* (Cambridge, Mass.: Harvard University Press, 1995). Dupré largely addresses biology but makes reference to quantum mechanics.
17. Morris Kline, *Mathematics: The Loss of Certainty* (New York: Oxford University Press, 1980), 3.
18. For the context of Einstein’s aphorism, see chapter 3, n. 56. Einstein’s contemporary at Princeton, the distinguished physicist Eugene P. Wigner, takes a different tack from either Einstein or Kline. In a witty and justly renowned meditation, Wigner argues: “The first point is that the enormous usefulness of mathematics in the natural sciences is something bordering on the mysterious and that there is no rational explanation for it. Second, it is just this uncanny usefulness of mathematical concepts that raises the question of the uniqueness of our physical theories.” For the second point, he offers the analogy of a man with a bunch of keys having to open a series of doors in quick succession, who always hits on the right key on his first or second try. He naturally “became skeptical concerning the uniqueness of the coordination between keys and doors.” That is, the keys seem to work too well, so that any key—or almost any—will do, raising questions about the fit, and the doors they open, and even the meaning of “key” (Eugene P. Wigner, “The Unreasonable Effectiveness of Mathematics in the Natural Sciences,” *Communications in Pure and Applied Mathematics* 13 [February 1960]: 1–14).
19. George Musser, “Was Einstein Right?” *Scientific American* 291 (September 2004): 89.
20. Werner Heisenberg, *The Physicist’s Conception of Nature* [*Das Naturbild der Heutigen Physik* (1955)], trans. Arnold J. Pomerans (London: Hutchinson, 1958), 41. Heisenberg’s italics.
21. John Wheeler, “Law Without Law,” in *Quantum Theory and Measurement*, ed. J. A. Wheeler and W. H. Zureck (Princeton, N.J.: Princeton University Press, 1983).
22. John Bell, “Against Measurement,” *Physics World* (August 1990).
23. Anton Zeilinger, “On the Interpretation and Philosophical Foundation of Quantum Mechanics,” in *Vastakohtien todellisuus, festschrift for K. V. Laurikainen*, ed. U. Ketvel et al. (Helsinki: Helsinki University Press, 1996).
24. Zeilinger, “Interpretation,” 5, 6, quoting from correspondence in the Pauli Letter Collection, CERN, Geneva, item 4992.063.
25. Anton Zeilinger, “The Message of the Quantum,” *Nature* 438 (December 2005): 743.
26. Zeilinger, “Interpretation,” 5.
27. John Horgan, “From Complexity to Perplexity,” *Scientific American* (June 1995): 109. The symposium, in 1994, was at the Santa Fe Institute. For a compendious view of the subject, see *Impossibility: The Limits of Science and the Science of Limits* (Oxford: Oxford University Press, 1998), by the mathematician and prolific science writer John D. Barrow.
28. Francis Bacon, “The New Organon,” chaps. 41 and 42, in *Francis Bacon: A Selection of His Works*, ed. Sidney Warhaft (New York: Odyssey, 1965), 336. Cf. Shelley’s resonant simile from *Adonais*: “Life, like a dome of many-coloured glass, / Stains the white radiance of Eternity.”
29. Heisenberg, *The Physicist’s Conception of Nature*, 15. See chapter 3.
30. Heisenberg, *The Physicist’s Conception of Nature*, 29. Italics in the original. Heisenberg quotes Arthur Eddington as stating “with such impressive brevity” the essential insight of modern physics: “We have found a strange footprint on the shores of the unknown. We have devised profound theories, one after another, to account for its origin. At last, we have succeeded in reconstructing the creature that made the footprint. And lo! it is our own.” Eddington’s footprint neatly bridges two resonant narratives of alien exploration, Defoe’s *Robinson Crusoe* (1719) and *Forbidden Planet* (1956), the classic science-fiction film based on *The Tempest*, where the largely invisible creature and its bizarre (chaotic) footprint are manifestations of the scientist’s unconscious mind.
31. This prediction from the theory, named for its authors “the Bose-Einstein condensate,” was first produced phenomenally in 1995 at the University of Colorado at Boulder by Eric Cornell and Carl Wieman, for which they, with Wolfgang Ketterle of MIT, were awarded the Nobel Prize in physics (2001).

32. Werner Heisenberg, *Physics and Beyond: Encounters and Conversations*, trans. Arnold J. Pomerans (New York: Harper & Row, 1971), 122.
33. For an explanation of “the general mystery” that conveys both the paradoxes and the complex symmetries of “the experiment with the two holes,” see Richard Feynman, *The Character of Physical Law* (1965; repr. New York: Modern Library, 1994), 124–142.
34. Dennis Overbye, “Celebrating a Century of Confusion and Triumph,” *New York Times*, December 12, 2000. For Overbye, the seven hundred physicists and historians marking the occasion in Berlin had gathered “to celebrate a theory whose meaning they still do not understand but that is the foundation of modern science.”
35. Tom Stoppard, *Hapgood* (London: Faber and Faber, 1994), 40. This edition, issued when the play was revived, trims and to some extent updates politically the original 1988 edition.
36. Feynman, *Character of Physical Law*, 122, 123.
37. Cf. Max Born: “even in restricted fields a description of the whole of a system in one picture is impossible; there are complementary images which do not apply simultaneously but are nevertheless not contradictory and exhaust the whole only together.” *Physics in My Generation*, 107.
38. Michael Frayn, *Copenhagen* (New York: Anchor, 2000). Gerald Holton cites Bohr’s enthusiasm for William James, Kierkegaard, Schiller, and Ernst Mach in eliciting the intellectual background of the principle. See Gerald Holton, “The Roots of Complementarity,” in *Thematic Origins of Scientific Thought: Kepler to Einstein* (Cambridge, Mass.: Harvard University Press, 1973).
39. Dennis Overbye, “Quantum Trickery: Testing Einstein’s Strangest Theory,” *New York Times*, December 27, 2005. Einstein’s collaborators were Boris Poldolsky and Nathan Rosen.
40. See Peter Coles, *From Cosmos to Chaos: The Science of Unpredictability* (Oxford: Oxford University Press, 2006), 131–135.
41. See Edward P. Tryon, “Is the Universe a Vacuum Fluctuation?” *Nature* 248 (December 14, 1973): 396–397.
42. Their resurrection in different guise, based on a quantized theory of space, is discussed by Martin Bojowald in “Follow the Bouncing Universe,” *Scientific American* 299 (October 2008): 44–51. Bojowald acknowledges the difficulties of accessing the prehistory of the universe and, further, that the hypothetical bounce “was not a brief push by a repulsive force, like the collision of billiard balls. Instead it may have represented the emergence of our universe from an almost unfathomable quantum state—a world in highly fluctuating turmoil” (50)—or in more traditional language, from chaos.
43. John D. Barrow, “The Endless Unknown,” *New York Times*, May 19, 1998.
44. Laurence M. Krauss and Robert J. Scherrer, “The End of Cosmology?” *Scientific American* 298 (March 2008): 46–53. Also, Laurence M. Krauss and Robert J. Scherrer, “The Return of a Static Universe and the End of Cosmology,” *Journal of General Relativity and Gravitation* 39 (October 2007): 1545–1550.
45. James Clerk Maxwell, *Matter in Motion* (1876), reprinted in *The Great Ideas Today* (Chicago: Encyclopedia Britannica, 1986), 396. In her peerless discussion of “Wave Theory and the Rise of Literary Modernism,” Gillian Beer gives Maxwell a central role as a transitional, or rather a bridging figure, and cites related passages where Maxwell invokes Helmholtz observing the waves or characterizes our situation “on a pathless sea, starless, windless and poleless.” See *Open Fields: Science in Cultural Encounter* (Oxford: Clarendon, 1996), 301–302. Beer elicits the endemic unease already in play in late nineteenth-century science, in physics and mathematics as well as in evolution’s social derivatives, preparing the ground for the liberated modernist creativity of the coming century both in the arts and the physical sciences.
46. Eugène Scribe, *Le verre d’eau; ou, les effets et les causes* (1840), in *Oeuvres complètes de M. Eugène Scribe* (Paris, 1841), vol. 5, pt. 2; adapted as *The Glass of Water* by W. E. Suter (London: T. H. Lacy, 1863[?]).
47. See James Gleick, *Chaos: Making a New Science* (New York: Viking, 1987), 65–69. Among the most energetic of the early promoters was Joseph Ford of the Georgia Institute of Technology.
48. George Santayana, *Dominations and Powers* (New York, Scribner, 1951), 33. Santayana’s first chapter is titled “Chaos and Order.”
49. Cited by Kate Flint in *The Victorians and the Visual Imagination* (Cambridge: Cambridge University Press, 2000), 111; from G. H. Lewes, *The Physiology of Common Life* (Edinburgh: Blackwood, 1859–1860), 2:3.
50. Santayana’s is a much bleaker vision. “Chaos is perhaps at the bottom of everything: which would explain why perfect order is so rare and precarious. Even when conquered by form in some particular, chaos revenges itself and proves its fundamental dominance by besieging that form with all sorts of violence or insidious disease, until the form dissolves, and the flux of existence reverts to a nameless continuity” (*Dominations and Powers*, 33). He takes refuge, finally, out of this world.
51. The quoted phrase is Mitchell Feigenbaum’s, the mathematician who early on provided powerful and beautifully simple tools for the new field.
52. See Frank Durham and Robert D. Purrington, “Newton, Nonlinearity, and Determinism,” in *Some Truer Method: Reflections on the Heritage of Newton*, ed. Frank Durham and Robert D. Purrington (New York: Columbia University

Press, 1990), 207, 212. The phrase “alternative intuition” is credited to the MIT astronomer Jack Wisdom. Leo Kadanoff, a theoretical physicist with wide interests, believes that “the concentration upon chaos has been part of a change in our understanding of what it means for a law to be ‘fundamental’ or ‘basic.’” He argues against what he calls “the reductionist prejudice,” the view of nature in which “there are fundamental laws and everything follows immediately and directly from them. Following this line of thought, one would construct a hierarchy of scientific problems. The ‘deepest’ problems would be those connected with the most fundamental things,” which, understood, can be built upon to explain all other observable phenomena. But given recent examples of powerful generalizations that “could not in any very natural way have been deduced from any more ‘basic’ sciences...it seems rather foolish to think about a hierarchy of scientific knowledge.” With this in mind, he turns to “the rich variety of chaotic systems” and the broad general principles that reach across them. See “Chaos: A View of Complexity in the Physical Sciences,” in *The Great Ideas Today* (Chicago: Encyclopedia Britannica, 1986), 66–67.

53. Aesthetic appeal, no less than unexpected behaviors, unanticipated regularities, fresh puzzles, and challenging hints, produced a whole new field called “experimental mathematics.” And fractal geometries have been read back into art with modest success. See Ivars Peterson, “Escape Into Chaos,” *Science News* 125 (1984): 328–329; R. P. Taylor, A. P. Micolich, and D. Jonas, “Fractal Analysis of Pollock’s Drip Paintings,” *Nature* 339 (June 3, 1999): 422; and Richard P. Taylor, “Order in Pollock’s Chaos,” *Scientific American* 287 (December 2002): 116–122. But the most persuasive aesthetic vindication lies in the remarkable confections of Hollywood’s computer-generated filmic “reality.”
54. In 1987, having demonstrated chaotic tumbling in the history of most moons in the solar system (but not ours) and how chaotic phenomena arise in the asteroid belts, the astronomer Jack Wisdom reported that the question was open as to whether the solar system as a whole is stable or whether the planets themselves will eventually go chaotic; “so far...the solar system seems stable” (*New York Times*, January 20, 1987). By 1993, a science writer could report that “scientists analyzing the motions of planets with powerful computers are realizing that there is a certain cacophony, as it were, to the music of the spheres. In the new scientific lexicon, the solar system is chaotic” (John Noble Wilford, “Moon May Save Earth from Chaotic Tilting of Other Planets,” *New York Times*, March 2, 1993). The piece cites current articles in *Nature* by Jacques Laskar and in *Science* by Jack Wisdom. See also the earlier article by Jack Wisdom and Gerald Jay Sussman, “Numerical Evidence That the Motion of Pluto Is Chaotic,” *Science* 241 (July 1988): 433–437, with implications for the rest of the solar system.
55. Ben Jonson’s scene description for *The Masque of Blackness*, in Inigo Jones, *The Theatre of the Stuart Court*, ed. Stephen Orgel and Roy Strong (London: Sotheby Parke Bernet, 1973), 1:90. For Novalis, see chapter 6.
56. Wallace Stevens, “Connoisseur of Chaos,” in *The Palm at the End of the Mind*, ed. Holly Stevens (New York: Vintage, 1972), 166–168.
57. Alan Garfinkel, in conversation with Judith Hooper, “Connoisseurs of Chaos,” *Omni* 5 (June 1983): 112.
58. From a 1967 essay originally titled “Science and New Styles of Thought,” incorporated into Gerald Holton, *Thematic Origins of Scientific Thought* (Cambridge, Mass.: Harvard University Press, 1973), 92.
59. The New Museum of Contemporary Art, New York, offered *Strange Attractors: Signs of Chaos* (exhibition catalogue, 1989). Some later films that consciously reflect aspects of chaos theory include *Run Lola Run* (Lola rennt, 1998) and the less interesting *Chaos Theory* (2007).
60. Robert Pool, “Chaos Theory: How Big an Advance?” *Science* 245 (July 7, 1989): 26–28.
61. Harmke Hamminga, “What Is This Thing Called Chaos?” *New Left Review* 181 (May/June 1990): 49.
62. Langdon Winner, reviewing books by M. Mitchell Waldrop and Roger Lewin, *New York Times Book Review*, February 14, 1993, 12.
63. John Horgan, “From Complexity to Perplexity,” *Scientific American* 272 (June 1995): 105–106.
64. Naomi Oreskes, Kristin Shrader-Frechette, and Kenneth Belitz, “Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences,” *Science* 263 (February 4, 1994), 644.
65. Virginia Woolf, “Modern Novels,” *Times Literary Supplement*, April 10, 1919. This is the first version of Woolf’s well-known critique of the generation of Wells, Bennett, and Galsworthy, ultimately rendered as “Modern Fiction” in *The Common Reader*. Her complaint, falling most heavily on Bennett, is that despite “his magnificent apparatus for catching life...Life escapes; and perhaps without life nothing else is worthwhile.” Hermione Lee quotes the paragraph and puts the essay in perspective in her classic biography *Virginia Woolf* (New York: Knopf, 1997), 399–400.
66. James P. Crutchfield, J. Dooyne Farmer, Norman H. Packard, and Robert S. Shaw, “Chaos,” *Scientific American* 225 (December 1986): 48, 49. The question of a meaningful similarity between “classical” chaos and the quantum regime, as possibly amenable to clarification by experiment, is discussed in a report in *Nature* 300 (November 25, 1982): 311.
67. Steven Strogatz, *Sync: The Emerging Science of Spontaneous Order* (New York: Theia, 2003); and Steven Strogatz, “The Real Scientific Hero of 1953,” *New York Times*, March 4, 2003.
68. Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man’s New Dialogue with Nature* (Toronto: Bantam, 1984).
69. See George Johnson, “From Grains of Sand: A World of Order,” *New York Times*, September 8, 1996. The distinguished physicist Murray Gell-Man, writing in *The Quark and the Jaguar*, thinks that all one needs is (in Johnson’s paraphrase) “the wild card of randomness.” His colleague, Stuart Kauffman, argues that “something extra

is needed” to explain such accretions of complexity, “a grand principle that would explain how order inexorably arises in the world...laws that are as fundamental and inexorable as those of physics.”

70. Alan Guth, *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins* (Reading, Mass.: Addison-Wesley, 1997), 243.
71. See Linde’s “Inflationary Multiverse” and related images and film clips at <https://web.stanford.edu/~alinde/> and his illustrated article “The Self-Reproducing Inflationary Universe,” *Scientific American* 271 (November 1994): 48–55.
72. James Joyce, *Finnegans Wake* (New York: Viking, 1947), 118.

## 1. SHAPING CHAOS

1. Augustine, *St. Augustine’s Confessions*, with an English Translation by William Watts, 1631, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1960–1961), 2:294–295.
2. Herman Melville, *Moby-Dick; or, The Whale*, ed. Harrison Hayford and Hershel Parker (New York: Norton, 1967), chap. 3, pp. 20–21.
3. See Woodburn Heron, *The Pathology of Boredom* (San Francisco: W. H. Freeman, 1957); and John C. Lilly, “Mental Effects of Reduction of Ordinary Levels of Physical Stimuli on Intact, Healthy Persons,” *Psychiatric Research Reports* 5 (1956): 1–9.
4. *The Temple of the Muses*; or, *The Principal Histories of Fabulous Antiquity* (Amsterdam: Z. Chatelain, 1733), 2–3. The text here translates the original of Michel de Marolles in *Les tableaux du temple des muses* (Paris, 1655). The original engravings for the Paris edition, after Diepenbeek’s designs, were by Cornelis Bloemart. That reproduced here is by Bernard Picart, finely copied from the original with the addition of a heavy confining frame.
5. Novalis writes in Heinrich von Ofterdingen (1802), “Ich möchte fast sagen, das Chaos muß in jeder Dichtung durch den regelmäßigen Flor der Ordnung schimmern.” In *Novalis Schriften: Die Werke Friedrich von Hardenbergs*, ed. Paul Kluckhohn and Richard Samuel (Stuttgart: W. Kohlhammer, 1960/1977), 1:286. Among the most impressive of latter-day efforts to rationalize the part played by disorder in art is Rudolf Arnheim, *Entropy and Art: An Essay on Disorder and Order* (Berkeley: University of California Press, 1971).
6. The phrase first appears as a chapter title in J. Middleton Murry, *Jonathan Swift: A Critical Biography* (London: Cape, 1954) but became current with Norman O. Brown’s best-selling *Life Against Death: The Psychoanalytical Meaning of History* (Middletown, Conn.: Wesleyan University Press, 1959), esp. 179–201.
7. In the first of *The Dunciad’s* Homeric games, a race between booksellers, the unfortunate Curl slips in the morning deposit of one of his female allies before his rival’s shop and prays to Jove for succor. Jove, in the place where “from Ambrosia [he] retires for ease,” has Curl’s plight brought to his attention by the goddess Cloacina, the bookseller’s particular patron. Curl so favored shows his mettle:

Renew’d by ordure’s sympathetic force,  
As oil’d by magic juices for the course,  
Vig’rous he rises; from th’effluvia strong  
Imbibes new life, and scours and stinks along...

(book 2, ll. 103–106)

8. Michael Seidel, “Satire and Metaphoric Collapse: The Bottom of the Sublime,” in *Satire in the Eighteenth Century*, ed. J. D. Browning (New York: Garland, 1983), 116.
9. Among Dickens’s late great projections of a society that institutionalizes disorder on its way to apocalypse, the great dust heaps—waste deposits of accumulated capital—and the corpse-polluted river of *Our Mutual Friend*, memorably uniting chaos and the cloacal, also speak to the horror, personal and universal, of organic death and dissolution.

## 2. NOTHING AND SOMETHING

1. Sir Thomas Elyot, *The Boke, Named the Governour* (1531), 2nd ed. (London: Thomas East, 1580), 2r.
2. Rig Veda, trans. J. A. B. Van Buitenen, in *Sources of the Indian Tradition*, 2 vols., ed. and rev. Ainslee T. Embree (New York: Columbia University Press, 1988), 1:21. The editors suggest the analogy of an egg in the last line.
3. Hesiod, *Theogony*, ll. 116ff., as translated in G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge: Cambridge University Press, 1969), 24–25.
4. William Blake, *The First Book of Urizen*, in *Poetry and Prose*, ed. Geoffrey Keynes (London, 1927), 246.
5. Drew A. Hyland finds in Hesiod’s account of differentiation something analogous to Heidegger’s “the between.” See



- Drew A. Hyland, "First of All Came Chaos," in Heidegger and the Greeks, ed. D. A. Hyland and J. P. Manoussakis (Bloomington: Indiana University Press, 2006), 9–22. For a critique of received interpretations, see Mitchell Miller's "The Implicit Logic of Hesiod's Cosmogony: An Examination of Theogony 116–133," *Independent Journal of Philosophy* 4 (1983): 131–142; and Mitchell Miller, "First of All: On the Semantics and Ethics of Hesiod's Cosmogony," *Ancient Philosophy* 21 (2001): 251–276.
6. The Poetic Edda, trans. Lee M. Hollander, 2nd rev. ed. (Austin: University of Texas, 1987), 2. Frederick York Powell, an earlier translator, renders ginnunga-gap as "Yawning Chasm." See Edda Saemundar: Volospa, in *Norse Mythology: The Elder Edda in Prose Translation*, ed. Lawrence S. Thompson (Hamden, Conn.: Archon, 1974), 15. Ymir is the primeval giant, slain by Odin and his brothers, from whose substance the world was shaped. He is variously interpreted from attached poetic epithets, sometimes as an ice-cold undifferentiated primal ocean.
7. Other related words are hiatus (from Latin hiare), gasp, and yawn. The family connection emerges in the apocalyptic yawn initiating the restoration of chaos in Pope's Dunciad.
8. The Septuagint gives chasma (chasm), but in Zechariah's prophesy of the cleaving of the Mount of Olives (Zech. 14:4), it uses chaos for what the New Revised Standard renders as "a very wide valley."
9. John Calvin, *Commentaries on the First Book of Moses Called Genesis*, trans. John King (Grand Rapids, Mich.: Eerdmans, 1948), 1:73 (Latin original, 1554). The editor notes that Calvin's own Latin rendering of the Hebrew text is informis et inanis, "shapeless and empty." Jerome's Bible renders the passage as inanis et vacua.
10. Louis H. Gray believes that the concept was unknown in Western and Near Eastern antiquity (*Encyclopaedia of Religion and Ethics*, ed. James Hastings [Edinburgh, 1954], 4:126). Charles H. Long points out, however, that although creation from nothing is "usually identified with the monotheistic religions of the Semitic tradition, it is a more pervasive structure" and that elsewhere (he cites Polynesian myth) "the deity exists in the void in himself and by himself; the autonomous and self-created nature of the deity appears out of the void or out of nothingness, which are understood to be potent realities" (*Encyclopedia of Religion*, ed. Mircea Eliade [New York: Macmillan, 1987], s.v. "Cosmogony").
11. As in Edward P. Tryon, "Is the Universe a Vacuum Fluctuation?" *Nature* 246 (December 14, 1973): 396–397.
12. The Anchor Bible: Genesis, ed. and trans. E. A. Speiser (New York: Doubleday, 1964), 3.
13. Alexander Heidel, *The Babylonian Genesis*, 2nd ed. (Chicago: University of Chicago Press, 1963), 89–96. Still in the heyday of the Higher Criticism, Rabbi and Professor (Chicago) Emil G. Hirsch wrote, "Whatever may be the nature of the traditions in Genesis...and however strong may be the presumption that they suggest the existence of an original substance which was reshaped in accordance with the Deity's purposes...it is clear that the Prophets and many of the Psalms accept without reservations the doctrine of creation from nothing by the will of a supermundane personal God" (*The Jewish Encyclopedia* [New York: Funk and Wagnalls, 1901–1906], 4:336, s.v. "Creation").
14. Enuma Elish, in *Ancient Near Eastern Texts Relating to the Old Testament*, 3rd ed., ed. J. B. Pritchard, trans. E. A. Speiser (Princeton, N.J.: Princeton University Press, 1969), 60–61, ll. 1–9. Mummu-Tiamat is sometimes interpreted as "Mother-Tiamat." Texts come from a number of Mesopotamian locations, and none antedates 1000 B.C., though there is some agreement that the composition belongs to the "Old Babylonian" period, early in the second millennium B.C. Some Sumerian scholars connect the English word "abyss" (Greek abyssos, bottomless) with the primordial waters also rendered as "the Abzu."
15. Van Helmont offers the term in his *Ortus Medicinae* (1648): "halitum illum Gas vocavi, non longe a Chao veterum secretum" (or in John Chandler's 1662 translation, "for want of a name, I have called that vapour, Gas, being not far [removed] from the Chaos of the Aunts"; both cited in the OED). It is likely that van Helmont was influenced also by the technical use of the term in European alchemy, where chaos is a name given to states of primal matter and also sometimes identified with water. In van Helmont's "metachemistry" as construed by Walter Pagel, while elemental and undifferentiated matter is water, gas "is just that water which has been...embossed and 'signed' by a semen, and presents itself in a volatile condition...it is exhalation specifically charged." See Pagel's authoritative monograph, *Joan Baptista van Helmont: Reformer of Science and Medicine* (Cambridge: Cambridge University Press, 1982), 35–36, 52, 62–64. A bridging figure, van Helmont not only identified discrete gases and theorized their nature but was responsible for "the major chemical generalization of the century, the recognition that alkalis and acids neutralize each other" (Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* [Cambridge: Cambridge University Press, 1983], 18).
16. Lucretius, *De Rerum Natura*, 2nd rev. ed., ed. Martin Ferguson Smith, trans. W. H. D. Rouse, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1982). Epicurus, for Lucretius the source of enlightenment, writes, in an epitome of his system, "Moreover, the universe is (bodies and space)... And if there were not that which we term void and place and intangible existence, bodies would have nowhere to exist and nothing through which to move, as they are seen to move ("Epicurus to Herodotus," in *Epicurus: The Extant Remains*, ed. and trans. Cyril Bailey [Oxford: Clarendon, 1926], 22–23). The words in parenthesis were editorially supplied.
17. From Aristotle's *Physics*, as quoted, with other commentators, in G. S. Kirk and J. E. Raven, *The Presocratic Philosophers: A Critical History with a Selection of Texts* (Cambridge: Cambridge University Press, 1969), 252.
18. Kirk and Raven, *The Presocratic Philosophers*, 269; cf. 272–275, on the associated denials of time, the void, and

plurality. When Leibniz poses his famous question, “Why is there something rather than nothing?” in his *Principles of Nature and Grace*, the shoe is on the other foot.

19. In Aristotle’s account in his *Metaphysics*, “Leucippus and his associate Democritus hold that the elements are the full and the void; they call them being and not-being respectively. Being is full and solid, not-being is void and rare. Since the void exists no less than body, it follows that not-being exists no less than being.” Quoted in Kirk and Raven, *The Presocratic Philosophers*, 406–407. Aristotle’s own rejection of the notion and possibility of a void would have a long influence on physical thought. See E. J. Dijksterhuis, *The Mechanization of the World Picture: Pythagoras to Newton*, trans. C. Dikshoorn (Princeton, N.J.: Princeton University Press, 1986), e.g., 39–40.
20. Kathleen Freeman, *The Pre-Socratic Philosophers* (Cambridge, Mass.: Harvard University Press, 1959), 303–304. Cf. Aristotle, *On Democritus* (by way of Simplicius), quoted in Kirk and Raven, *The Presocratic Philosophers*, 407.
21. F. M. Cornford, for example, remarks of both chaos and the demiurge, “neither is to be taken quite literally, yet both stand for real elements in the world as it exists. If there was never a moment of creation, chaos cannot have existed before that moment; and this part of the mythical imagery is not to be taken at face value. F. M. Cornford, *Plato’s Cosmology: The Timaeus of Plato Translated with a Running Commentary* (London: Routledge & Keegan Paul, 1956), 37. See also Leonardo Taran, “The Creation Myth in Plato’s *Timaeus*,” in *Essays in Ancient Greek Philosophy*, ed. John P. Anton with George L. Kustos (Albany, N.Y.: SUNY Press, 1971), 372–407. A more literalist reading was long argued by Gregory Vlastos. See his important essay of 1939, “The Disorderly Motion in the *Timaeus*,” in *Studies in Plato’s Metaphysics*, ed. R. E. Allen (New York: Humanities Press, 1965), 379–399; and the extension of its argument in “Creation in the *Timaeus*: Is It a Fiction?” 401–419.
22. As rendered by Cornford, modifying earlier translations, in *Plato’s Cosmology*. Parenthetical references (e.g., 52d) are standard for the Greek text and many of its translations. For a fluent, exceedingly readable modern translation, see Robin Waterfield’s version in the *Oxford World’s Classics* (2008).
23. Werner Heisenberg remarks of the notion that space—bereft of the crutch of an “ether”—has physical properties, “This may not seem satisfactory from a philosophical point of view, from which one would prefer to attach physical properties only to physical entities like material bodies or fields and not to empty space. But so far as the theory of electromagnetic processes or mechanical motions is concerned the existence of physical properties of empty space is simply a description of facts that cannot be disputed.” He also observes, with a nod to both the *Timaeus* and the Pythagoreans, “In modern quantum theory there can be no doubt that the elementary particles will finally also be mathematical forms, but of a much more complicated nature [than those known to the Greeks].” Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (1958; repr. New York: Harper and Row, 1962), 120, 71–72.
24. Gregory Vlastos points out in *Plato’s Universe* (Seattle: University of Washington Press, 1975) that the Greek word *kosmos*, unlike the English, has a verb form, *kosmeō*: to set in order, to marshal, to arrange. The first extant use of *kosmos* for the universe or the world-order is in Heraclitus. (Other candidates credited with first use by early sources, according to Liddell and Scott’s *Greek-English Lexicon*, are Pythagoras and Parmenides.) But Vlastos notes that Heraclitus broke the dominant cosmogonic pattern by postulating “a cosmology without a cosmogony,” a dynamic steady-state universe: “not the static order of architectonic pattern” but “the dynamic order which marks the intertransformations of its elements” (6–7).
25. Heisenberg, *Physics and Philosophy*, 147–148.
26. Guillaume de Saluste Sieur Du Bartas, *The Divine Weeks and Works of Guillaume de Saluste Sieur Du Bartas*, trans. Josuah [sic] Sylvester (Oxford: Clarendon, 1979), 2:117. “The First Day of the First Weeke,” ll. 217–218.
27. Ovid (Publius Ovidius Naso), *Metamorphoses*, 3rd ed., ed. and rev. G. P. Goold, trans. Frank Justus Miller, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1984), book 1, ll. 5–20.
28. John Donne, “A Sermon Preached at the Spittle, Upon Easter-Munday, 1622,” in *The Sermons of John Donne*, ed. George R. Potter and Evelyn M. Simpson (Berkeley: University of California Press, 1959), 4:100–101. In another vein, in “A Nocturnall Upon S. Lucies Day, Being the Shortest Day” (Donne’s poem on a devastating grief), he imagines a reverse alchemy, like a perverse Creation, in which love expresses

A quintessence even from nothingnesse,  
From dull privations, and lean emptinesse:  
He ruin’d mee, and I am re-begot  
Of absence, darknesse, death; things which are not.

“An ordinary nothing” would have some shadow of being to it, says the poet. “But I am by her death...Of the first nothing, the Elixir grown.” He finds the correlative for his state, as it were, in the formless void, raised to a higher power.

29. “Nichil nichil est. / Materia prope & pene nichil est: non tamen nichil. / Materia est entis & nichili medium. / Nichil minus est ensq materia. / Ex nichilum nichil fit.” See *Que hoc volumine contine[n]tur. Liber de intellectu. Liber de sensu. Liber de nichilo. Ars oppositorum. Liber de generatione. Liber de sapiente. etc.* (Paris, 1510). Columbia University

Library, Rare Books and Manuscripts.

30. Robert Fludd, *Utriusque Cosmi Maioris scilicet et Minoris Metaphysica, Physica atque Technica Historia* (Oppenheim and Frankfurt, 1617–1624); first part, *De Macrocosmi Historia* (1617), 25. Fludd disputes Augustine's argument in *Contra Manicheos* that darkness is nothing but the privation of light (26).
31. Malevich's famous Black Square (ca. 1915) inevitably comes to mind here, though the painting carries its own distinctive burden of intellectual and contextual meaning. It was Malevich's declared ambition at the time to create "formless painterly masses," and the painting first showed at an exhibition called "0.10," to signify nothing as represented by ten artists. ("Later on," Malevich wrote, "we too will go beyond zero.") See Michael Dobbs, "Russia's Reclaimed Master," *Washington Post* (March 6, 1989).
32. Reiner Schürmann, *Meister Eckhart, Mystic and Philosopher, a Translation and Commentary* (Bloomington: Indiana University Press, 1978), 86.
33. "Entre ces deux abîmes de l'infini et du néant." Blaise Pascal, *Pensées* 185, in *Oeuvres complètes*, ed. Michel Le Guern, Bibliothèque de la Pléiade (Paris: Gallimard, 2000), 609.
34. Quoted from Descartes' second Meditation by Michel Serres, in "Knowledge in the Classical Age: La Fontaine and Descartes," in *Hermes: Literature, Science, Philosophy*, ed. Josué V. Harari and David F. Bell (Baltimore, Md.: Johns Hopkins University Press, 1982), 26.
35. Pascal, *Pensées* 397, in a series headed "Infini rien," 676.
36. From Pascal's public correspondence with Père Noël, S.J., over the issue of the void, in *Oeuvres complètes*, ed. Louis Lafuma (Paris: Éditions du Seuil, 1963), 179.
37. Charles Baudelaire, *Oeuvres*, ed. Y.-G. Le Dantec, Bibliothèque de la Pléiade (Paris, 1931), 193.
38. Georg Büchner, *Dantons Tod: Ein Drama*, ed. Joachim Hagner (Frankfurt am Main: Suhrkamp Verlag, 2007), 73–74.
39. Johann Wolfgang von Goethe, *Faust* (Part One), ll. 1349–1352.
40. Friedrich Engels, *Dialectics of Nature*, trans. Clemens Dutt (New York: International Publishers, 1940), 251–252.
41. Henri Bergson, *Creative Evolution*, trans. Arthur Mitchell (New York: Henry Holt, 1911), 274–275. Arthur Danto, the philosopher and critic, remarks, "In a late work, *Principles of Nature and Grace*, Leibniz posed the stunning question, 'Why is there something rather than nothing?' Heidegger declared this 'the ground-question of metaphysics,' and put it in his own way: 'Why is there any being at all—why not far rather nothing?'" *Times Literary Supplement* (April 28, 1989): 448. Wittgenstein reformulates the issue in *Tractatus* 6:44: "Not how the world is, is the mystical, but that it is."
42. Stanislaw Lem, *The Cyberiad: Fables for the Cybernetic Age*, trans. Michael Kandel (New York: Harcourt Brace Jovanovich, 1985), 3–8.
43. For a subtle reading of Lem's fable and the ethically driven dialectic between writing (language) and reality in his work, see N. Katherine Hayles's authoritative *Chaos Bound: Orderly Disorder in Contemporary Literature and Science* (Ithaca, N.Y.: Cornell University Press, 1990), 115–140.

### 3. NUMBER: THE ONE AND THE MANY

1. Written, photographed, and directed by Zbigniew Rybczynski, produced by Se-Ma-For/Film Polski, music by Janusz Hajduk (8 minutes, color). It won the Academy Award for Best Animated Film in 1982.
2. Alexander Heidel notes that "the general view that the creation of heaven and earth was accomplished in part by a process of division or separation is 'common property of almost all cosmogonies.' Thus in Egypt the air-god Shu separated heaven and earth by lifting the sky-godess Nut from the earth-god Geb and placing himself between the two, while according to Phoenician and Indian speculation the cosmic egg or world egg split into heaven and earth." Alexander Heidel, *The Babylonian Genesis* (Chicago: University of Chicago Press, 1963), 115. Shu's separating action appears in a number of Egyptian bas-reliefs, like that represented and interpreted in Adolf Erman, *Die Religion der Ägypter* (Berlin: De Gruyter, 1934; repr. 1968), 62–63.
3. Robert Alter, *The Art of Biblical Narrative* (New York: Basic Books, 1981), 142–143. In "Création et séparation," *Le Muséon* 74 (1961): 441–451, Émile Dantinne discusses the etymology of the verb *bara*, "create," in Genesis 1:1, a word used in the Hebrew scriptures to mean "create" only in connection with acts of God. Elsewhere, Dantinne argues, it has the sense "to cut" or "to divide." According to Claus Westermann in his monumental *Genesis 1–11: A Commentary*, trans. John J. Scullion, S.J. (Minneapolis: Augsburg, 1984), 99, "there is no other convincing attempt to trace the derivation."
4. The page bearing the illustration is incorporated in a multivolume grangerized text ("The Kitto Bible") now in the Huntington Library, vol. 1, no. 128. It shows some hand coloring and is dated by hand 1476. Other, more elaborate representations of the cosmos entire from the fifteenth century forward may be found in S. K. Heninger's authoritative survey, *The Cosmographical Glass: Renaissance Diagrams of the Universe* (San Marino, Calif.: Huntington Library, 1977), esp. chap. 1, "Creation."
5. Giulio Romano executed the fresco from Raphael's design. See Nicole Dacos, *Le logge di Raffaello: maestro e*

- bottega di fronte all'antico, 2nd ed. (Roma: Istituto Polygrafico e Zecca dello Stato, 1986), 150–151, tavola 9. Giulio's painting is reproduced (in color) in Nicole Dacos, *The Loggia of Raphael: A Vatican Art Treasure* (New York: Abbeville, 2008), plate 89, p. 140.
6. See the enriched version of the Hertel edition of 1758–1760 edited by Edwin A. Maser, *Cesare Ripa: Baroque and Rococo Pictorial Imagery* (New York: Dover, 1971), fol. 166.
7. Howard Nemerov, *New and Selected Poems* (Chicago: University of Chicago Press, 1960), 27–29. The image of the stone in the pool has a notable pedigree. Isaac Newton, for example, arguing a wave theory of light, begins one of his questions in *Opticks* (1704), "If a stone be thrown into a stagnating Water, the Waves excited thereby continue some time to arise in the place where the Stone fell into the Water, and are propagated from thence in concentrick Circles upon the Surface of the Water to great distances." *Opticks* (New York: Dover, 1979), book 3, part 1, query 17, pp. 347–348.
8. The Tango phenomenon would probably also be understood in cognitive psychology as a function of "attention," a distinctly limited mental resource. The writer of one textbook offers the spatial analogy of a narrow workspace that gets too crowded (cf. Tango); from energetics he adduces a limited electric current whereby "attention would only be allocable to so many tasks. (If allocated to more, the performance would degrade or a fuse would blow)." John R. Anderson, *Cognitive Psychology and Its Implications* (San Francisco: Freeman, 1980), 26. If one approaches by way of pattern perception, there appears to be an optimum level of complexity as measured by the brain's response to graphic designs, using electroencephalograms. "Less arousal occurs...when the design is more complicated than the optimum." See Edward O. Wilson, *Biophilia* (Cambridge, Mass.: Harvard University Press, 1984), 78, citing the work of Gerda Smets.
9. John Calvin, *Commentaries on the First Book of Moses Called Genesis*, trans. John King (Grand Rapids, Mich.: Eerdmans, 1948), 78–79.
10. For Elyot, see above. Ulysses' homily is in *Troilus and Cressida*, 1.3.
11. *The Works of Philo Judaeus*, trans. C. D. Yonge (London: Bohn, 1854), 1:3.
12. St. Augustine, *The City of God*, book 9, chap. 30 ("On the Perfect Number Six").
13. For a juxtaposition of Oedipus and Lear that is germane to the discussion that follows, see the "The Chaos of Quantity" in William R. Elton's *King Lear and the Gods* (San Marino, Calif.: Huntington Library, 1966), 121–125.
14. "'To know' ( oida, eidenai) is a word built into the fabric of Oedipus' name and ironically emphasized in line after line of the play." Bernard M. W. Knox, *Oedipus at Thebes* (New York: Norton, 1971), 127. Seeing and knowing are also intimately linked in this verb, as they are in the dire action at the end of the play. As one dictionary explains, "the [perfect, oida], I have seen, is used as a present in the sense I know (for what one has seen, one knows)." *The Classic Greek Dictionary* (Chicago: Follett, 1962), s.v. \*eido.
15. Lines 977–979, 1082. Translations of more than a phrase are from David Grene, *Oedipus the King*, in *The Complete Greek Tragedies*, ed. David Grene and Richmond Lattimore (Chicago: University of Chicago Press, 1954).
16. Knox, *Oedipus at Thebes*, 147–158.
17. In a cultural generalization drawing upon other authorities, Thomas Crump writes, "that where numerical techniques are known—even at the elementary level of separating numbers into odd and even—they are used as 'paradigms of identity.'" (Thomas Crump, *The Anthropology of Numbers*, Cambridge Studies in Social Anthropology 70 [Cambridge University Press, 1990], 4).
18. Cf. Aristotle's later definitions of plurality: "Plurality, when limited, is a number" (*Metaphysics*, book 5, sec. 1020a); "Plurality is, as it were, a genus of number, since number is plurality measurable by one" (*Metaphysics*, book 10, sec. 1057a). *The Basic Works of Aristotle*, ed. Richard McKeon (New York: Random House, 1941). Though he has little use for number mysticism, Aristotle also writes, "The chief forms of beauty are order and symmetry and definiteness, which the mathematical sciences demonstrate in a special degree" (*Metaphysics*, book 13, sec. 1078b). The terms are taxis, which imports arrangement; symmetria; and to horisimenon, which comes from a verb for separating, limiting, making boundaries, defining (cf. "horizon").
19. *Enneads* 1.8, in Plotinus, trans. A. H. Armstrong, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1966), 282–283.
20. Frederick Engels, *Dialectics of Nature*, trans. Clemens Dutt (London: Wishart, 1940), 182.
21. R. C. Jebb's distillation, in his edition of *The Oedipus Tyrannus of Sophocles* (Cambridge: Cambridge University Press, 1958), xiii. In the classical retellings of the Oedipus story, the text of the riddle fluctuates about a stable core. In Apollodorus's collection of myths, *The Library*, trans. J. G. Frazer, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1976), 1:347, it appears as, "What is it that has one voice and yet becomes four-footed and two-footed and three-footed?" (book 3, chap. 5, sec. 8). Cf. Diodorus Siculus (4.64.3–4). It is worth noting that in his exposition of how identity and the principle of contradiction inform predication, Aristotle uses the example of "being a man" and "not being a man," and offers as a working definition, "if 'man' has one meaning, let this be 'two footed animal'" (*Metaphysics* 4, sec. 1006a–b).
22. Knox, *Oedipus at Thebes*, 154.



23. Knox, *Oedipus at Thebes*, 157–158. Elsewhere (39–42) Knox convincingly expounds a more interactive view.
24. Werner Heisenberg, *Physics and Beyond: Encounters and Conversations*, trans. Arnold J. Pomerans (New York: Harper & Row, 1971), 122–123.
25. Heisenberg's attempt to assimilate Niels Bohr's complementarity principle to quantum uncertainty, as paraphrased by N. Katherine Hayles, *The Cosmic Web* (Ithaca, N.Y.: Cornell University Press, 1984), 51. Cf. Werner Heisenberg, *Physics and Philosophy* (New York: Harper, 1958), 49–55.
26. Thomas Heath, *A History of Greek Mathematics* (Oxford: Clarendon, 1921; repr. 1960), 1:30–31, 1:35; Georges Ifrah, *From One to Zero: A Universal History of Numbers*, trans. Lowell Bair (New York: Viking, 1985), 225–229.
27. On "element," Charles Kahn writes: "In Greek, as afterwards in Latin, this expression is based on a comparison of the physical principles to the letters of the alphabet (the primary meaning of  $\tau\acute{\alpha}\ \sigma\tau\omicron\iota\chi\epsilon\iota\acute{\alpha}$ ). This comparison seems to have been introduced by the atomists." Charles Kahn, *Anaximander and the Origins of Greek Cosmology* (New York: Columbia University Press, 1964). The Leucippus paraphrase is quoted from Kathleen Freeman, *The Pre-Socratic Philosophers*, 2nd ed. (Cambridge, Mass.: Harvard University Press, 1959), 287.
28. Plato, *Philebus* (15b–18b), trans. R. Hackforth in *The Collected Dialogues*, ed. Edith Hamilton and Huntington Cairns (New York: Bollingen, 1961), 1091–1094. In the *Timaeus* (48b), Plato puns on *stoicheia* in rejecting the conventional four elements as not even furnishing the syllables, let alone the basic letters or primal stuff.
29. Oswald Spengler, *The Decline of the West*, trans. Charles Francis Atkinson (New York: Knopf, 1973), 1:59–60.
30. Whatever the feeling in earlier times, Aristotle is able to treat the matter very coolly. He remarks on the "incommensurability of the diagonal of a square with the side," that "it seems wonderful to all who have not yet seen the reason, that there is a thing that cannot be measured even by the smallest unit," but in fact "there is nothing which would surprise a geometer so much as if the diagonal turned out to be commensurable" (*Metaphysics*, book 1, sec. 983a). By this time the difficulties of irrationals and infinitesimals (as in the paradoxes of Zeno) "were solved, or at least circumscribed, by Eudoxus...c. 360. He formulated a general theory of proportion including both commensurable and incommensurable magnitudes, and also invented the method of approach to the limit which became the standard Greek way of dealing with problems involving infinitesimals." G. T. Toomer, "Mathematics," *Oxford Classical Dictionary*, 2nd ed. (Oxford: Clarendon, 1970), s.v.
31. Aristotle, *Metaphysics*, book 13, chap. 6, sec. 1080b.
32. For a clarifying analysis based chiefly on Aristotle, see G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge: Cambridge University Press, 1969), esp. 242–248, on the complexities of the even and the odd. The basic explanatory account of Pythagorean number theory is in Heath, *Greek Mathematics*, esp. 1:65–97.
33. "Evidently, then, these thinkers also consider that number is the principle both as matter for things and as forming their modifications and their permanent states..." (*Metaphysics*, book 1, chap. 5, sec. 986a.).
34. Twentieth-century Pythagorean resonances are to be found, for example, in Heisenberg's reflections on what relativity, field theory, and uncertainty have wrought. Cf. his comments on the *Timaeus* in *Physics and Beyond*, 7, 241. Elsewhere he remarks, with provoking aplomb, "we have learned from recent developments that the whole struggle is between Democritus and Plato—Plato was right and Democritus was wrong." Werner Heisenberg, *The Nature of Scientific Discovery: A Symposium*, ed. Owen Gingrich (Washington: Smithsonian, 1975), 557.
35. Diogenes Laertius, *Lives of Eminent Philosophers*, trans. R. D. Hicks, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1970), book 8, ch. 1, sec. 25; 2:341–342.
36. Kirk and Raven, *The Presocratic Philosophers*, 256.
37. Friedrich Nietzsche, paraphrasing Schopenhauer, in *Die Geburt der Tragödie aus dem Geiste der Musik*, in *Nietzsches Werke* (Leipzig: C. G. Naumann, 1899), 1:22–23; *The Birth of Tragedy*, trans. Wm. A. Haussmann (Edinburgh: Foulis, 1909), 25 (quoted).
38. C. G. Jung, *Psychology and Alchemy*, 2nd ed., trans. R. F. C. Hull. Bollingen Series 20 (Princeton, N.J.: Princeton University Press, 1980), 90.
39. Nietzsche, *The Birth of Tragedy*, trans. Haussmann, 74–75. See *Nietzsches Werke*, 1:66–68.
40. René Girard, *Le bouc émissaire* (Paris: Bernard Grasset, 1982), 24–25.
41. See Bernard Knox, "The Date of the Oedipus Tyrannus," *American Journal of Philology* 77 (1956): 133–147. As Knox demonstrates, "the plague in Thebes seems to be a Sophoclean invention," his addition to the story of Oedipus, making the connection between Sophocles' Theban plague and that of Athens "more probable" (134–135). It is a second visitation, however, that Knox finds most pertinent to the play's dating, probably 425 BCE.
42. Thucydides, *History of the Peloponnesian War*, trans. Rex Warner (Harmondsworth: Penguin, 1972), 52–53 (book 2, sec. 51).
43. Aristotle, *Rhetoric*, trans. John Henry Freese, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1975), book 3, chap. 10 (1410b).
44. Aristotle, *Poetics*, trans. Ingram Bywater (ch. 22, sec. 1458a), in *Basic Works*, 1478.
45. Janine Chasseguet-Smirgel, *Creativity and Perversion* (New York: Norton, 1984), 9.

46. Plato, *Timaeus* (51a–b), trans. R. G. Bury, in *Plato*, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1981), 9:119.
47. Michael Serres, “Mathematics and Philosophy: What Thales Saw,” in *Hermes: Literature, Science, Philosophy*, ed. Josué Harari and David Bell (Baltimore, Md.: Johns Hopkins University Press, 1982), 84; originally published as “Ce que Thalès a vu au pied des pyramides,” in *Hermès II* (Paris: Minuit, 1972).
48. Victor Hugo, William Shakespeare, part 1, book 3, sec. 2; in *Victor Hugo: Critique* (Paris: Robert Laffont, 1985), 293. The passage as a whole is powerfully imaginative, copious and rapturous in its naming.
49. Gerald Holton, *Thematic Origins of Scientific Thought: Kepler to Einstein* (Cambridge, Mass.: Harvard University Press, 1973), 17.
50. William James, *The Principles of Psychology* (Chicago: Encyclopedia Britannica, 1952), 876.
51. P. G. Tait, *Heat* (1884; repr. London: Macmillan, 1895), 8.
52. “What Future for the Chaos Concept,” in “News and Views,” *Nature* 300 (November 25, 1982): 311.
53. James, *Principles of Psychology*, 862.
54. James, *Principles of Psychology*, 862–863n. James here also cites a passage from J. S. Mill’s *Logic* (3.7.1) beginning: “The order of nature, as perceived at first glance, presents at every instant a chaos followed by another chaos.”
55. James, *Principles of Psychology*, 876. In noting the axiom in geometry that figures can be moved in space without change, James comments proleptically, “But if translation through space warped or magnified forms, then the relations of equality, etc., would always have to be expressed with a position qualification added. A geometry as absolutely certain as ours could be invented on the supposition of such a space, if the laws of its warping and deformation were fixed. It would, however, be much more complicated than our geometry, which makes the simplest possible supposition; and finds, luckily enough, that it is a supposition with which the space of experience seems to agree” (877).
56. Albert Einstein, “Geometry and Experience” (lecture before the Prussian Academy of Sciences, 1921), in *Ideas and Opinions*, trans. Sonja Bargmann (London: Souvenir, 1973), 233. Einstein is here arguing for a “practical geometry,” bridging axiomatic mathematics and physical reality but subject to the trials of experience.
57. Cf. Douglas Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid* (New York: Basic Books, 1979). Among the moderns, not all mathematicians reflecting on Gödel’s bombshell were of Hofstadter’s mind. See for example Morris Kline, *Mathematics: The Loss of Certainty* (New York: Oxford University Press, 1980).
58. James Gleick, obituary of Richard Feynman, *New York Times* (February 17, 1988).
59. For Bohr’s interest in James’s *Principles of Psychology*, notably his account of “stream of consciousness” (so important to the experimental literature of the 1920s), see Gerald Holton, “The Roots of Complementarity,” in *Thematic Origins of Scientific Thought* (Cambridge, Mass.: Harvard University Press, 1973), 137–139.
60. Heisenberg, *Physics and Philosophy*, 181.
61. Werner Heisenberg, “Development of Concepts in the History of Quantum Theory,” *American Journal of Physics* 43 (May 1975): 393. Cf. his *Physics and Philosophy*, 160, where “the complete mutability of matter” is offered reassuringly as “the final proof” of its unity.
62. Werner Heisenberg, *The Physicist’s Conception of Nature*, trans. Arnold J. Pomerans, from *Das Naturbild der Heutigen Physik* (London: Hutchinson, 1958), 15.
63. Heisenberg, *Physics and Beyond*, 231, 234.

## 4. CARNIVAL

1. Edmund Ronald Leach, “Two Essays Concerning the Symbolic Representation of Time,” in *Rethinking Anthropology* (London: London University Press, 1961), 135.
2. Macrobius notes that Saturn, conventionally represented with feet bound together, is described as “set free on the day of his festival” (the December Saturnalia) and says of the castration of Cronus and subsequent events like the birth of Venus that it is “a myth from which we are meant to understand that, while chaos lasted, times and seasons did not exist.” See Macrobius, *The Saturnalia*, trans. Percy Vaughan Davies (New York: Columbia University Press, 1969), book 1, chap. 8, p. 64.
3. Ovid, *Fasti*, trans. James George Frazer, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1976), 1:8–11, ll. 103–114.
4. Ovid, *Fasti*, 1.163. The Latin *ianua* for door and doorway and related words in other languages provide a sounder etymological clue to the god’s function and name.
5. Terry Castle most convincingly argues the radical possibilities of masquerade, as it took institutionalized form and then entered imaginative literature, in *Masquerade and Civilization: The Carnavalesque in Eighteenth-Century English*

- Culture and Fiction (London: Methuen, 1986). Leach has just such politer forms of masquerade in mind, “celebrations of the Fancy Dress Party type,” in treating the category as relatively innocuous. But that it can be used to evade and effectively undermine the rigors of patriarchy, for example, furnishes the plot in Aphra Behn’s racy Restoration comedy *The Rover* (1677), set in Carnival time, in Naples.
6. Mikhail Bakhtin, *Problems of Dostoevsky’s Poetics*, trans. Carol Emerson (Minneapolis: University of Minnesota Press, 1984), 130.
  7. On continuities with the classical rhetorical figure of *adynata* or *impossibilia*, see Ernst Robert Curtius, *European Literature and the Latin Middle Ages*, trans. Willard R. Trask, Bollingen Series 35 (Princeton, N.J.: Princeton University Press, 1973), 94–98.
  8. It appears, for example, in the engraving after Bruegel’s design for *Temperance*, on a flag hanging over a stage performance that brings together elevated gentry with a fool and his bauble.
  9. See David Kunzle’s comprehensive “World Upside Down: The Iconography of a European Broadsheet Type,” in *The Reversible World: Symbolic Inversion in Art and Society*, ed. Barbara A. Babcock (Ithaca, N.Y.: Cornell University Press, 1978), 39–94. In his “Bruegel’s Proverb Painting and the World Upside Down,” *Art Bulletin* 59 (June 1977), Kunzle further observes that the natural and social impossibilities represented in the broadsheets become “constituents of a complete world that could, at any time of social stress, be taken to represent an existing, or threatening, or desired reality” (198).
  10. Christopher Hill uses this passage as the epigraph for his classic account of the Levelers and radical dissenting movements of the Commonwealth era: Christopher Hill, *The World Turned Upside Down: Radical Ideas During the English Revolution* (New York: Viking, 1972).
  11. Carl Gustaf Stridbeck would include *Children’s Games*, the third large painting of these years, as a similar “allegory of the foolish and sinful world, the ‘World Turned Upside Down,’ in which human beings deceive themselves and each other in a mad, materialistic, profoundly senseless life.” See Carl Gustaf Stridbeck, *Bruegelstudien: Untersuchungen zu den ikonologische Problemen bei Pieter Bruegel d. A.* (Stockholm: Almqvist & Wiksell, 1956), 11. Kunzle (“Bruegel’s Proverb Painting”) convincingly argues for a more complex program in the *Netherlandish Proverbs* and distinguishes between the reversed-world and proverb genres.
  12. W. H. Auden, “Musée des Beaux Arts.” See also William Carlos Williams, “Landscape with the Fall of Icarus.”
  13. For the first reading, see Carl Gustaf Stridbeck, “‘Combat Between Carnival and Lent’...An Allegorical Picture of the Sixteenth Century,” *Journal of the Warburg and Courtauld Institute* 19 (January–June 1956): 96–109, also incorporated in his *Bruegelstudien*. For the second, see Claude Gaignebet, “Le combat de carnaval et de carême de P. Bruegel (1559),” *Annales* 27 (March–April 1972): 313–345.
  14. Though it seems unlikely that the mock-knightly combat, tournament style, is “a true representation of a scene performed in a Carnival play,” there are two proper theatrical presentations depicted in the scene. See Hanns Swarzenski, “The Battle Between Carnival and Lent,” *Bulletin of the Museum of Fine Arts* 49 (February 1951): 2.
  15. Charles Baudelaire, “Quelques caricaturistes étrangers,” *Le Présent* (October 15, 1857); reprinted in his *Curiosités esthétiques* (Paris, 1868).
  16. See the essay of Natalie Zemon Davis that brought this motif into deserved prominence, “Women on Top,” in *Society and Culture in Early Modern France: Eight Essays* (Stanford, Calif.: Stanford University Press, 1975), 124–151. Davis speaks of Bruegel’s “terrifying Dulle Griet,” which, painted during the Spanish occupation of the Netherlands, “makes a huge, armed, unseeing woman, Mad Meg, the emblem of fiery destruction, of brutal oppression, and disorder.” But Davis points out that the painting “cuts in more than one way,” so that, for example, “Next to Mad Meg is a small woman in white on top of a male monster; it is Saint Margaret of Antioch tying up the devil” (129). The joke in Davis’s title reaches back to Aristophanes. In *Lysistrata*, the title character keeps her wavering troops up to the mark by reading them the oracle, that if they hold out, their troubles will end, and Zeus “shall put above what before was below.” (“What!” one listener exclaims, “Shall the men be underneath?”) In *The Ecclesiazusae*, a utopian fantasy rife with role reversal and transvestism where women take charge of the polity, the women’s program for society entails a strict leveling in both goods (through a system of communal property) and sexual access (through affirmative action for the old and ugly).
  17. Cf. the fragment of a painting cited in Charles de Tolnay, *Hieronymus Bosch* (Basel: Editions Holbein, 1937), 90, cat. no. 9 (plate 30).
  18. Tilde Sankovich, quoted by R. H. Marijnissen in “Bosch and Bruegel on Human Folly,” in *Folie et déraison à la renaissance: colloque international tenu en novembre 1973 sous les auspices de la Fédération internationale des instituts et sociétés pour l’étude de la Renaissance* (Bruxelles: Éditions de l’Université de Bruxelles, 1976), 50.
  19. The theory of the anomalous within cultural formations found its most cogent expositor in Mary Douglas, in her classic *Purity and Danger* (London: Routledge, 1966).
  20. Blaise Pascal, *Oeuvres complètes*, ed. Michel Le Guern, Bibliothèque de la Pléiade (Paris: Gallimard, 2000), 2:580, no. 122. Pascal’s human monster, his “chaos,” is a collection of antinomies, a specific type of the anomalous compound form. A taxonomy of chaotic monstrosity, however, would want to leave room for a liminality that escapes

such binarism, though it is a rare monster that can be imagined without reference to existent species and recognizable forms. Perhaps the nearest approach to such unfixed liminality is to be found in the negativity of, for example, the Boyg in Ibsen's *Peer Gynt*. At the furthest taxonomic limit and indeed complementing Pascal's binary chaos as an existential threat is that species of antecosmic monster whose very scale denies or annuls structure and difference, like the oceanic Tiamat and her avatars.

21. Subsequent citations are from *The Complete Plays of Ben Jonson*, ed. G. A. Wilkes (Oxford: Clarendon, 1981–1982), vol. 4. Jonson's play and its anarchic festivity have benefited from an extensive body of insightful criticism. Comment and analysis directly pertinent to the account that follows may be found in Ian Donaldson, *The World Upside-Down: Comedy from Jonson to Fielding* (Oxford: Clarendon, 1970), where Donaldson identifies two powerful principles in the genre: inversion and leveling; and Peter Stallybrass and Allon White, *The Politics and Poetics of Transgression* (Ithaca, N.Y.: Cornell University Press, 1986). Stallybrass and White qualify Bakhtin's carnivalesque in useful ways and bring a wealth of thought and insight to bear on Bartholomew Fair, with which they exemplify a "complex interconnection of theatre, fair and authorship." Finally, Rocco Coronato, in *Jonson Versus Bakhtin: Carnival and the Grotesque*, *Textual Studies in Comparative Literature* 41 (Amsterdam: Rodopi, 2003), directly challenges the populist and revolutionary premises of Bakhtinian criticism, finding in Jonson an unbending conservative skeptic and critic of popular impulse and carnival license.
22. That the fairs as producers of revenue would develop their own elaborate instruments of law, regulation, and privilege, from royal charter to special courts, is only to be expected. Fair law and fair interests, however, often came into conflict with ordinary law and local interests, as illustrated in the history of the two greatest English examples, Stourbridge Fair, near Cambridge, and Bartholomew Fair, in London. See the accounts in Cornelius Walford, *Fairs Past and Present: A Chapter in the History of Commerce* (1883), *Reprints of Economic Classics* (New York: Augustus M. Kelley, 1968); and in Henry Morley, *Memoirs of Bartholomew Fair* (London: Chapman & Hall, 1859). In *The Fairs of Medieval England: An Introductory Study* (Toronto: Pontifical Institute, 1985), Ellen Wedemeyer Moore concludes that "the whole ponderous structure, in fact, of the rules and institutions which governed every aspect of life at fairs was necessary to the functioning of these unusually free markets" (296).
23. From the enormous literature addressing the social, political, and cultural dimensions of carnival behavior, Natalie Zemon Davis's "The Rites of Violence" and "The Reasons of Misrule" are particularly pertinent, collected in *Society and Culture in Early Modern France* (Stanford, Calif.: Stanford University Press, 1975). See also Emmanuel Le Roy Ladurie, *Carnival in Romans*, trans. Mary Feeney (New York: Braziller, 1979); and his earlier *The Peasants of Languedoc* (1966), trans. John Day (Urbana: University of Illinois, 1974), where he notes that the fantasy of inversion is "in an elementary way, to contest, to deny, to proclaim one's disaccord with the world as it is" (208–209).
24. Writing of the Carnival proper, Peter Burke notes that throughout Europe it was "a favourite time for the performance of plays" and that in fact "Carnival may be seen as a huge play in which the main streets and squares became stages, the city became a theatre without walls and the inhabitants, the actors and spectators." See Burke's compendious, historically argued *Popular Culture in Early Modern Europe* (London: Temple Smith, 1978), 182.
25. In Bruegel's painting (1567), where food and drink, table ready, grow on trees, tarts appear in place of roof tiles, roast goose and buttered egg offer themselves to the sated, a pig trots by with slice out and carving knife handy, tucked in a loop of crackling, while knight, peasant, and clerk (or scholar) lie stupefied under the table-tree like spokes on a wheel, lost to distinctions in this land where abundance rather than scarcity is the rule, aliment requires no effort to produce or acquire, money is irrelevant, and cold and danger are remote.
26. Both pig and pig woman as the presiding incarnation of the fair are richly indebted to Rabelais's book 4, with the battles of Shrovetide, Friar Jan (or Jhon), and the Wild Chitterlings (Andouilles). Anticipating an attack, Pantagrue gives his Colonels the watchword, *Mardigras* (chap. 37). Friar Jan, mustering his cooks, orders the engineers to fit up the Great Sow, a kind of Trojan Horse fighting machine (chap. 40). After misunderstandings, Friar Jan and his forces sally out, armed with spits, pans, andirons, tongs—an arsenal of iron cookery ware—and do great havoc until "a wonderful thing": a great winged swine flies in from the North, "huge, fat, thick, grizzly," with wings like a windmill, crimson plumes, and a red and flaming eye. The chitterlings fall in adoration, and Pantagrue calls off hostilities; the monster hovers, and "with a tail-shot voided above twenty-seven butts of mustard." It then flies away "crying all the while Carnival, Carnival, Carnival" (chap. 41). Later, the Queen of the Chitterlings explains that the great beast was "the Idea of Carnival [*Mardigras*], their tutelary God, in time of War" and founder of the entire race (chap. 42): *Oeuvres de Rabelais*, ed. Louis Moland, 2 vols. (Paris: Garnier, 1950); *The Works of Rabelais Completely Translated Into English by Urquhart and Motteux* (London: "Published for the Trade," n.d. [1653 and 1708]).
27. The preacher has lineal descendants in Samuel Butler's dissenting knight errant *Hudibras* and his illuminated squire, Ralpho, launched in the early Restoration (First Part, 1663). Butler characterizes Ralpho as an adept in esoteric heterodoxy, like that of Cornelius Agrippa and Robert Fludd, with its mystical and alchemical bearings. In marking Ralpho's familiarity with primal chaos, Butler links it and Reformation to the versions still on display at Bartholomew Fair:

The Chaos too he had descry'd,



And seen quite through, or else he ly'd:  
 Not that of Past[e]-board which men shew  
 For groats at Fair of Barthol'mew;  
 But its great Grandsire, first o' th' name,  
 Whence that and Reformation came:  
 Both Cousin-germans, and right able  
 T' inveigle and draw in the Rabble.  
 But Reformation was, some say,  
 O' th' younger house to Puppet-play.

(Hudibras, ed. John Wilders [Oxford: Clarendon, 1967], 17–18 [1.1.557–566])

28. John Bunyan, *The Pilgrim's Progress from This World to That Which Is to Come*, 2nd rev. ed., ed. James Blanton Wharey and Roger Sharrock (Oxford: Clarendon, 1967), 81.
29. The "Vanity" state of the print is found in a single copy of the first edition (Huntington Library). See Bunyan, *The Pilgrim's Progress*, ed. Wharey and Sharrock, xxviii–ix, for Robert White's account of the two versions.
30. *The Taming of the Shrew*, Arden ed., ed. Brian Morris (London: Methuen, 1981), induction i, 61–62, and 69–70.
31. *A Pleasant Conceited Historie, called The taming of a Shrew* (1594), reprinted in Geoffrey Bullough, ed., *Narrative and Dramatic Sources of Shakespeare* (New York: Columbia University Press, 1957), 1:68–108.
32. See Antti Aarne and Stith Thompson, *The Types of Folktale: A Classification and Bibliography*, 2nd rev. ed. (Helsinki, 1964), types 1531, 1313A\*, 1526.
33. See E. P. Thompson, "'Rough Music': Le charivari anglais," *Annales* 27 (March–April 1972): 285–312.
34. See the inventor's *Mémoires récréatifs, scientifiques et anecdotiques du physicien-aéronaute E. G. Robertson* (Paris, 1831–34); and Jac Remise, Pascale Remise, and Regis van de Walle, *Magie lumineuse, du théâtre d'ombres à la lanterne magique* (Paris: Ballaud, 1979). On its Paris opening in 1798, the *Fantasmagorie* featured sensations of terror, mortality, the uncanny, and the supernatural.
35. Dream, madness, and theatrical illusion converge in the experience of Peregrine, the protagonist of Richard Brome's *The Antipodes* (1636), the most elaborately developed English play using the trope of the upside-down world. In *The Antipodes*, Peregrine, enamored of the travel literature of the age, is cured of his obsessive longings and neglect of his distraught and unbedded wife by being fictively "transported" (while drugged and asleep) to the other side of the world, where all is opposite to England: the people rule the magistrates, wives rule husbands (who are domestic in their duties), and child and servant are obeyed; poets are rich and lawyers poor and fee avoiding; game pursue the hawks and deer the hounds; cats are kept in cages to protect them from mice; great scholars, growing backward in learning, are sent to school at sixty; street people are refined and courtiers rude; women sexually aggressive and men retiring, etc. In this world—enacted by players—Peregrine crowns himself King of the Antipodes before setting about putting things to rights. Eventually, introduced to his wife and taking her as queen, he finally beds her, and with sanity restored, carnival kingship and queenship are forgotten "and but suppos'd their dreams" (Richard Brome, *The Antipodes*, ed. Ann Haaker [Lincoln: University of Nebraska Press, 1966]). The trope of the Reversed World in foreign parts goes back at least to Herodotus, discoursing on the wonders of Egypt, where "the people also, in most of their manners and customs, exactly reverse the common practice of mankind. The women attend the markets and trade, while the men sit at home at the loom," etc. (*The History of Herodotus*, trans. George Rawlinson, Everyman ed. [1936], book 2, chap. 35, p. 129. Sophocles—whom Herodotus reportedly befriended while in Athens—has Oedipus at Colonus compare his sons "to the ways of Egypt...For in that country the men sit within doors / Working the loom, while the wives go out / To get the daily bread" (ca. l. 368).
36. See the end of the first jornada or act, where Clotaldo, Segismundo's guardian, jailor, and tutor, finds himself at an impasse between allegiance and honor: Calderón de la Barca, *La vida es sueño* (Comedia, auto y loa), ed. Enrique Rull (Madrid: Alhambra, 1980), 1.975–985.
37. "La vida es sueño, auto hasta ahora ms.," in Angel Valbuena Prat, "Los autos sacramentales de Calderón (clasificación y análisis)," *Revue Hispanique* 61 (June 1924): 258–259.
38. Calderón de la Barca *La vida es sueño*. Drama y auto sacramental, ed. José María Valverde (Barcelona: Planeta, 1981), 118.
39. "All three poems [*Paradise Lost*, *Paradise Regained*, and *Samson Agonistes*] are deeply political, wrestling with the problems of the failed revolution, the millennium that did not come" (Christopher Hill, *Milton and the English Revolution* [London: Faber & Faber, 1977], 362).
40. See A. B. Chambers, "Chaos in *Paradise Lost*," *Journal of the History of Ideas* 24 (1963): 55–84; Harris Francis Fletcher, *Milton's Rabbinical Readings* (New York: Gordian, 1967), esp. 80–87, 128–151; Davis P. Harding, *Milton and the Renaissance Ovid* (Urbana: University of Illinois Press, 1946), chap. 5: "Paradise Lost," pp. 67–99; Mark D. Northrup, "Milton's Hesiodic Cosmology," *Comparative Literature* 33 (Fall 1981): 305–320.
41. Regine Schwartz suggests as much, finding as well associations with cloacal dregs and violations of Levitical law,

along with vestiges from Genesis to Revelation of primal and renewed battles between the Creator and a primordial oceanic abyss. Schwartz's wide-ranging, astutely argued essay "Milton's Hostile Chaos: '...And the Sea Was No More,'" ELH 52 (Summer 1985): 337–374, takes account of all the good reasons that led to "something like a critical conspiracy to detoxify chaos" (362).

42. Marcia R. Pointon, *Milton and English Art* (Toronto: University of Toronto, 1970), 74; Roland Mushat Frye, *Milton's Imagery and the Visual Arts* (Princeton, N.J.: Princeton University Press, 1978), 142. Undaunted, Conrad Metz attempted to show both, in an early nineteenth-century drawing where a declamatory classical Satan appears in the midst of Chaos's lightly draped court (Night excepted), framed by the brawling figures of the constellations (top) and the warring personified elements (bottom). Metz's synthesis of iconographic traditions, including the Ovidian chaos, the court of Hades as an underworld anti-Olympus, and entanglements of naked muscular figures to represent mythological battle or infernal torment, is impressive, if not entirely convincing. Described and illustrated in Pointon, *Milton and English Art*, 73–75. Fuseli's *Milton Gallery* painting (XI. Satan Bursts from Chaos) and his drawing of Satan's departure from the presence of Chaos with an upward leap are more actively suggestive of dynamic instability.
43. Commenting on *Paradise Lost*, Alastair Fowler points out a contemporary etymology for "Nimrod," deriving the name "from Hebrew mârād = Latin rebellis" (Alastair Fowler, *The Poems of John Milton* [London: Longman, 1971], 612n).
44. Civil war thereupon acquires some of the characteristics of the rivalries of nation-states with rich territories for colonization at stake. Beelzebub, however, points out to the fallen angels attracted to the idea of founding a "nether Empire," which in time might rise "In emulation opposite to Heav'n" (2.296–298), that Hell remains within the polity of Heaven, and their war thus continues as rebellion.
45. Aubrey L. Williams, *Pope's Dunciad: A Study of Its Meaning* (London: Methuen, 1955), 131–132, 136n, 138.
46. Quotations are from *The Dunciad in Four Books* (1743) unless otherwise noted. The principal published stages in the poem's evolution were the 1728 *Dunciad. An Heroick Poem*, in three books; the elaborately annotated *Dunciad Variorum* (1729); *The New Dunciad*, that is, book 4 (1742); and the final 1743 version with Colley Cibber substituted for Lewis Theobald as the King of the Dunces.
47. Only once does Pope suggest there is something creditable in a broad social appeal, and that is in a note on his deceased friend John Gay, whose "celebrated Beggar's Opera" he calls "a piece of satire which hits all tastes and degrees of men, from those of the highest quality to the very rabble" (book 3, l. 330n).
48. Satan's regal parody of divinity—here re-parodied—opens book 2 of *Paradise Lost*:

High on a Throne of Royal State, which far  
Outshone the wealth of Ormus and of Ind...  
Satan exalted sat.

(2.1–5)

49. Swift's Yahoos and Peer Gynt's apes—the "real-world" version in Ibsen's play of Peer's earlier coprophagous encounter with the trolls of his inner world—represent the unvarnished impulse in literature.
50. Giambattista Vico, *The New Science of Giambattista Vico*, trans. Thomas Goddard Bergin and Max Harold Fisch (Ithaca, N.Y.: Cornell University Press, 1968), 260.
51. Janine Chasseguet-Smirgel, *Creativity and Perversion* (New York: Norton, 1984), 11. The Eliade passage cited is from *Mephistophélès et l'androgyné* (Paris: Gallimard, 1962), 141.
52. From the "Code of Laws," in Donatien Alphonse François, Marquis de Sade, *The 120 Days of Sodom*, cited in Chasseguet-Smirgel, *Creativity and Perversion*, 3.

## 5. WAR

1. See John Keegan's sweeping overview in *A History of Warfare* (London: Hutchinson, 1993), where he includes anthropological evidence and perspectives. Keegan offers a caveat for those trying to understand conflict "in terms of abstractions about the 'nature of war,' since there is no such thing" (xi).
2. See Michael Howard, ed., *Restraints on War: Studies in the Literature of Armed Conflict* (Oxford: Oxford University Press, 1979); and (for a specific case), W. R. Connor on Hoplite battle codes, "Early Greek Warfare as Symbolic Expression," *Past & Present* 119 (May 1988): 3–29.
3. Bertolt Brecht, *Mother Courage and Her Children: A Chronicle of the Thirty Years War*, trans. Ralph Manheim (here modified), in *Brecht, Collected Plays*, ed. Ralph Manheim and John Willett (New York: Vintage, 1972), 5:135–136.
4. Lucretius, *De Rerum Natura*, trans. W. H. D. Rouse, rev. Martin Ferguson Smith, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1975).

5. Philo of Alexandria, "On the Creation of the World," in *The Works of Philo Judaeus*, trans. C. D. Yonge (London: H. G. Bohn, 1854), 8.
6. Guillaume de Saluste Sieur Du Bartas, *The Divine Weeks and Works*, trans. Josuah [sic] Sylvester, ed. Susan Snyder (Oxford: Clarendon Press, 1979), 1:118, and *First Day of the Second Week, Part Three, Argument*.
7. For a relatively recent essay arguing that war served a "constructive purpose" in the creation of European society, see Michael Howard, "War in the Making and Unmaking of Europe," in *The Causes of War and Other Essays* (London: Temple Smith, 1983), 151–168. Unlike some of his predecessors, however, Howard simply makes a historical claim for the shaping agency of war. In this he departs from the positive coloration in, for example, Werner Sombart's thesis in *Krieg und Kapitalismus* "that war had furthered the cause of human progress by facilitating the process of capital accumulation." But in dissociating himself from ethically framed approaches that see only the evils of war, Howard extends what Ira Katznelson describes as the "Otto Hintze-Max Weber realist tradition that stressed war, violence and coercion as hallmarks of stateness." See Michael Howard, *Restraints on War: Studies in the Limitation of Armed Conflict* (Oxford: Oxford University Press, 1979), 1; Ira Katznelson, "The State to the Rescue?" *Social Research* 59 (1992): 728.
8. Robert Fludd, *De Arte Militari*, title page, tomus primus, tractatus secundi, pars 6 of *Utriusque Cosmi Maioris et Minoris* (Openhemii, 1617–1621), 343.
9. John Davies, *Orchestra*, stanza 87, in *The Poems of Sir John Davies*, ed. Robert Krueger (Oxford: Clarendon, 1975), 113. The editor suggests that the poem, including such passages, should be credited with the essential levity of the paradoxical encomium (lxiv).
10. F. N. Maude, *War and the World's Life* (London: Smith, Elder, 1907), vii–ix. It is in the light of such argument and analogy that one has to see Brecht's epic-theater parable of a businesswoman in the wars ("Mother Courage"), where any correlation between business success and wartime virtues is distinctly problematic.
11. The pacific, mutually enhancing view of trade found popular ideological expression in George Lillo's celebrated tragedy of "private life," *The London Merchant; or, The History of George Barnwell* (1731). Thorowgood, lecturing his apprentices on "the method of merchandise" tells them, "'Twill be well worth your pains to study it as a science, to see how it is founded in reason and the nature of things, how it has promoted humanity as it has opened and yet keeps up an intercourse between nations far remote from one another in situation, customs, and religion; promoting arts, industry, peace, and plenty; by mutual benefits diffusing mutual love from pole to pole" (George Lillo, *The London Merchant*, ed. William H. McBurney [Lincoln: University of Nebraska, 1965], 3.3, p. 40). In the nineteenth century, Richard Cobden gave steadiest voice to the Manchester view of the antinomy between free trade making for material prosperity in an increasingly democratic milieu on the one hand and war and physical force as an instrument of policy on the other. See John Morley, *The Life of Richard Cobden* (London: Chapman and Hall, 1881), 2:70–71.
12. For Sun Tzu, see *The Art of War*, trans. Samuel B. Griffith (Oxford: Oxford University Press, 1963), 71. There are exceptions to Sun Tzu's generalization, even in a protracted war, when the home territories are insulated while all others engaged are devastated. Witness the case of the United States following World War II.
13. Quoted in John Keegan, *The Face of Battle* (New York: Viking, 1976), 115.
14. Kubin's original drawing was published in a portfolio of fifteen collotype facsimiles by Hans von Weber in 1903. Jordaan's fully mechanized avatar, in German helmet carrying mortar bomb and grenade against a Dutch landscape and an exploding sky, is reprinted in *Nachtmerrie over Nederland: Een herinnerings-album* (Amsterdam: De Groener Amsterdammer, 1945), an album marking the clandestine survival from 1940 to 1945 of the Dutch weekly *De Groener Amsterdammer*.
15. E. H. Gombrich, who discusses the semiotic spectrum of the painting's images, remarks that Rubens's Mars "is not a heroic warrior, he is a brutal butcher, rather stupid in bearing and physiognomy" (E. H. Gombrich, *Symbolic Images: Studies in the Art of the Renaissance* [London: Phaidon, 1972], 128). In some older catalogues, the painting was listed as *The Thirty Years War*, according to the entry in A. Jahn-Rusconi's official *La R. Galleria Pitti in Firenze* (Roma: Liberia dello Stato, 1937), 246, and such a topical reading of the painting, as a deeply felt response to contemporary history, is eminently plausible. Other titles have been *Le conseguenze della guerra* (Pitti) and *Les maux de guerre*. Edward Dillon could state that the painting illustrated "the thought that was uppermost in the mind of Rubens; it is the passionate expression of his detestation of that endless war for the cessation of which he had for so many years vainly striven" (Edward Dillon, *Rubens* [London: Methuen, 1909], 175). The painting was part of Napoleon's war booty, and it spent the years 1799 to 1815 in Paris.
16. National Gallery, London, #279, catalogued as "After Rubens," *An Allegory Showing the Effects of War* ("The Horrors of War"). Though the figure between Mars's legs is in the Pitti Palace painting, it is not among the details mentioned in Rubens's descriptive letter (see below), and Gregory Martin in the *National Gallery Catalogues, The Flemish School* (London, 1970) refers to it as "the sculpted bust of a man," which would be consistent with neighboring representations of the other trampled arts. However, several engravings after the painting also show the figure as a corpse. And in drawings for a subject that J. S. Held argues is closely related "to the great Allegory of War in the Palazzo Pitti" and that may well represent a stage in its development, the cognate figure is clearly marked with a bloody head wound. See Julius S. Held, *Rubens Selected Drawings* (London: Phaidon, 1959), I, #66, "Hercules and

- Minerva Fighting Mars,” and II, plate 74. See also Held, *The Oil Sketches of Peter Paul Rubens: A Critical Catalogue* (Princeton, N.J.: Princeton University Press, 1980), I, #244 and #253; and II, plates 254 and 253.
17. Peter Paul Rubens, *The Letters of Peter Paul Rubens*, trans. and ed. Ruth Sanders Magurn (Cambridge, Mass.: Harvard University Press, 1955), 408–409.
  18. Jacob Burckhardt, *Recollections of Rubens*, trans. Mary Bottinger, ed. H. Gerson (London: Phaidon, 1950), 114.
  19. Johann Theodor de Bry, *Proscenium Vitae Humanae, sive Emblematum secularium, iucundissima, & artificiosissima varietate Vitae Humanae...Sculptore Ioan. Theodoro de Bry* (Frankfurt: Guilielmi Fitzeri, 1627), 11.
  20. Bernadette Bucher, *Icon and Conquest: A Structural Analysis of the Illustration of de Bry's Great Voyages*, trans. Basia Miller Gulati (Chicago: University of Chicago Press, 1981), 6.
  21. Desiderius Erasmus, *The Complaint of Peace* [Querela Pacis, 1517], from a version printed in London in 1802 and reprinted in 1917 by Alexander Grieve (London: Headley Brothers), 49.
  22. Thomas Hobbes, *Leviathan*; Reprinted from the Edition of 1651 (Oxford: Clarendon, 1909), 96 (part 1, chap. 13).
  23. *Sunday Times* (London), October 31, 1993.
  24. From the *Buffalo News*, reprinted in the *New York Times*, August 27, 1995, sec. 4, p. 4. For other variants, e.g., Bill Charmatz's *Cold War cartoon Duet* (1983), with two smiling male figures, jowl to jowl, clasping hands and holding pistols to each other's heads, see D. J. R. Bruckner, Seymour Chwast, and Steven Heller, *Art Against War: Four Hundred Years of Protest in Art* (New York: Abbeville, 1984), 112.
  25. Antoine-Augustin Préault, *Tuerie*, modeled in plaster (1834); cast in bronze (1859), Musée des Beaux Arts, Chartres. Throwing in his lot with the insurgent Romantics, Préault (1809–1879) pioneered an expressive sculpture that broke with accepted canons and successfully alienated established institutions.
  26. Joseph Masheck, “Guernica as Art History,” *Art News* 66 (December 1967): 33.
  27. Rudolf Arnheim, *Picasso's Guernica: The Genesis of a Painting* (London: Faber, 1964), cites several such opposed views, including a negative reading that invokes “the mythical figure of the bull which rapes Europe” (23). Arnheim declares for “the imperturbable image of Spain.” An oedipal reading may be found in Alice Doumanian Tankard, *Picasso's Guernica After Rubens's Horrors of War: A Comparative Study in Three Parts—Iconographic and Compositional, Stylistic, and Psychoanalytic* (Philadelphia: Art Alliance Press; London: Associated University Presses, 1984). Masheck, “Guernica as Art History,” 35, argues for the bull as “the idea of an assaulted creature, above all, of a victim,” but one that endures his Christ-like martyrdom nobly and indeed triumphantly.
  28. Arnheim, *Picasso's Guernica*, 26.
  29. Masheck adduces the reference to Rubens's painting and some of its detail in arguing Picasso's continuation of “Grand Manner painting.” The relation is developed at length by Tankard, who in *Picasso's Guernica After Rubens's Horrors of War* convincingly demonstrates that *Guernica* presents in effect a mirror image of *The Horrors of War*, reversing left and right while systematically incorporating but sometimes displacing its elements. The reversal starts with the open door, now on the right, and ends with the sprawled, supine figure, now on the left. Masheck points out other seventeenth-century prototypes for Picasso's imagery, such as the fallen protagonist and his horse in Caravaggio's *Conversion of Saint Paul*, and a head in Guido Reni's *Massacre of the Innocents* for the woman with the lamp (66–67). The painting may also be seen as continuing the inherited dialectic between the *Massacre of the Innocents* and the *Scene in the Manger*. In a private communication, the historian Joseph Meisel shrewdly observes, “I have always seen *Guernica* as a perverted, horrific Nativity Scene (light bulb as Star of Bethlehem, mother and child, animals, etc.).”
  30. Hobbes, *Leviathan*, part 1, “Of Man,” chap. 13, p. 96.
  31. Hugo Grotius, *De Jure Belli ac Pacis Libri Tres*, vol. 2, *The Translation*, trans. Francis W. Kelsey et al. (Oxford: Clarendon, 1925), 33. From the edition of 1646, embodying the last revisions of the author (first version, 1625). Unlike Hobbes (and much neo-Darwinist argument) but in some respects following Grotius, anthropology made the case for seeing war as dependent on social existence. Margaret Mead, for example, argues that warfare is to be regarded “as a cultural invention consequent upon group identification, the existence of shared taboos against intra-group killing... and the equally culturally defined sanctioning of killing members of the opposing group.” Her criteria for distinguishing war as a social phenomenon from other activities extend beyond group identification and include “organization for the purpose of a combat involving the intention to kill and the willingness to die, social sanction for this behavior...and agreement between the groups involved on the legitimacy of the fighting with the intent to kill” (Margaret Mead, “Alternatives to War,” in Morton Fried, Marvin Harris, and Robert Murphy, eds., *War: The Anthropology of Armed Conflict and Aggression* [New York, 1968], 215–216). For a critique from within the discipline of the effort to distinguish between primitive and civilized war (and in effect to deny their common expression of a trait in human nature), see Lawrence H. Keeley, *War Before Civilization* (New York: Oxford University Press, 1996).
  32. Desiderius Erasmus, *Dulce Bellum Inexpertis* [War is sweet to those who have not tried it], in Margaret M. Phillips, *The “Adages” of Erasmus: A Study with Translations* (Cambridge: Cambridge University Press, 1964), 320. This “adage” or essay first appeared in a collection of 1515.
  33. Desiderius Erasmus, *The Complaint of Peace*. Translated from the Latin of Erasmus (London, 1802), 14, an eloquent



- (if somewhat free) anonymous translation, claiming to be “Re-Printed” in “The First Year of General Peace” and bearing hints of seditious republicanism. For a later translation, see the *Collected Works of Erasmus*, vol. 27, ed. A. H. T. Levi (Toronto: University of Toronto Press, 1986); for the Latin original, *Querela pacis undique gentium ejectae profligataeque*, see the *Opera Omnia*, part 4, vol. 2 (Amsterdam: North-Holland, 1972).
34. J. R. Hale, *Artists and Warfare in the Renaissance* (New Haven, Conn.: Yale University Press, 1990), 22.
  35. [Théodore] Agrippa d’Aubigné, *Les tragiques*, ed. A. Garnier and J. Plattard, *Société des Textes Français Modernes* (Paris: Libr. Marcel Didier, 1966), 1:67, ll. 372–374.
  36. George Clark, *War and Society in the Seventeenth Century* (Cambridge: Cambridge University Press, 1958), 73–74.
  37. See H. Diane Russell in the exemplary exhibition catalogue *Jacques Callot: Prints and Related Drawings* (Washington, D.C.: National Gallery, 1975), 246.
  38. J. R. Hale notes, among conventionalized elements, “the ‘forest of pikes,’” extended by German sixteenth-century woodcut artists in “the ‘fall of pikes’ motif that signaled the encounter of two forests, the leading ranks lowering their shaft weapons for conflict” (*Artists and Warfare in the Renaissance*, 138). Callot takes the motif a step further as marking the transition from order to disorder.
  39. The phrase on the Abbé’s facility is Edouard Meaume’s in the fundamental *Recherches sur la vie et les ouvrages de Jacques Callot* (Paris: Ve. Jules Renouard, 1860), 266.
  40. I use A. T. S. Goodrick’s durable 1912 translation, *The Adventurous Simplicissimus* (Lincoln: University of Nebraska Press, 1962). Bracketed modifications, where the translator was squeamish, derive from the scholarly edition of the 1669 German text: J. H. Scholte, *Grimmelshausens Simplicissimus Teutsch* (Halle/Saale: Max Niemeyer Verlag, 1938). See Mike Mitchell, *Simplicissimus* (Sawtry: Dedalus, 1999), for a fluent contemporary version. For historical overviews (in English) of the war and its catastrophic effects on the population and economy of the European heartland, see C. V. Wedgwood’s classic account, *The Thirty Years War* (1938; repr. London: Methuen, 1981); and Peter H. Wilson, *Europe’s Tragedy: A History of the Thirty Years War* (London: Allen Lane, 2009).
  41. J. R. Hale, *Artists and Warfare in the Renaissance*, 254, reproduces a remarkable miniature from a fifteenth-century Flemish manuscript of a “Tree of Battles,” with the various ranks from angels and kings to soldiers and peasants at war among themselves, with God looking down on all.
  42. Théophile Gautier, *Voyage en Espagne*. Nouvelle édition revue et corrigée (Paris: Charpentier, 1845), 129–130, 135. To secure his effects, Goya used a variety of techniques in addition to etching on his *Disasters* plates, including dry point, aquatint, and lavis (a toning acid wash).
  43. For an account of the uses of capriccio in art and music before Goya, see David Rosand, “Introduction. Capriccio: Goya and a Graphic Tradition,” in Janis A. Tomlinson, *Graphic Evolutions: The Print Series of Francisco Goya* (New York: Columbia University Press, 1989), 3–9.
  44. Two families of manuscripts, thought to reflect at least in part Goya’s own explanations, survive. What is called the Ayala manuscript, which is thought to be “very close to what Goya may have written and shown to trusted friends,” says of the print, “La fantasiá abandonada de la razón produce monstruos, y unida con ella es madre en las artes [Imagination deserted by reason produces monsters, and united with it is mother of the arts].” A preparatory drawing has written on the lower margin, in Goya’s hand, “The author dreaming. His one intention is to banish harmful beliefs commonly held, and with the work of caprichos to perpetuate the solid testament of truth.” See Eleanor A. Sayre et al., *The Changing Image: Prints by Francisco Goya* (Boston: Museum of Fine Arts, 1978), 100–101. I find unconvincing the reactionary romantic reading of Goya’s motto, which casts monstrosity as the reflex of reason itself, so that the Terror derives from the Enlightenment.
  45. An exception is plate 7, “Que valor!,” a depiction of the famous Maid of Saragossa singly serving a cannon while standing on a heap of the dead, also depicted by the Scottish painter David Wilkie and celebrated by Byron in *Childe Harold’s Pilgrimage*.
  46. The earlier numbering is likely to date from 1814 and evidently included some plates later omitted or replaced; the album of proofs, with the plates renumbered, rearranged, and augmented, dates from 1820. This numbering was followed in the first published edition, where however the concluding plates (81 and 82) were not available. I follow this standard numbering. For a brief and convincing account of the chronology and the inclusions at various stages, see Eleanor Sayre et al., *The Changing Image*, 128–129. Three plates bear the date 1810, and these seem to be among the earliest.
  47. Gautier, *Voyage en Espagne*, 135.
  48. Francis Klingender, *Goya in the Democratic Tradition* (London: Sidgwick & Jackson, 1948), 151.
  49. The preface to the first published edition from the Royal Academy of San Fernando (1863) refers to “the collection that he [Goya] designated with the name of Estragos or Desastres de la Guerra.”
  50. See Tomlinson, *Graphic Evolutions*, 31.
  51. Prevailing critical opinion connects the caprichos enfáticos rather narrowly to the period of reaction after the defeat of Napoleon, and important exhibitions have given the “allegorical” last group separate treatment (Sayre, *The Changing Image*). I have taken the view that their function is integral and that Goya’s melding of his earlier and later work in the

album that best represents his intentions for publication was by intellectual and aesthetic design.

52. "Misera humanidad la culpa es tuya," attributed on the parchment to the Italian poet Giovanni Battista Casti, author of *Gli animali parlanti* (1802). The animal is usually identified as a wolf despite its partly ursine appearance. It may be relevant that fox, bear, and dog, but not wolf, are important characters in Casti's long poem. The inscribed verse is a very free translation from the poem's conclusion, close to a French rendering of 1819. There, the hopes of a reign of liberty are given as doubtful, because "de tant d'obstacles, / Toujours guidé par vos vieilles erreurs, / Pauvres humains, vous êtes les auteurs" (Giovanni Battista Casti, *Les animaux parlans*, trans. L. Mareschal [Paris, 1819], 2:440 [chant 26]).
53. The best known is John Singer Sargent's *Gassed*, in the Imperial War Museum, London.
54. Recently the Prado has shifted attribution of *El coloso* to Goya's assistant, Asensio Juliá. It is worth noting that Byron resorts to such imagery in telling of Harold in Spain before the battle of Talavera (*Childe Harold's Pilgrimage* [1812], 1.39):

Lo! Where the Giant on the mountain stands,  
His blood-red tresses deep'ning in the sun,  
With death-shot glowing in his fiery hands,  
And eye that scorcheth all it glares upon...

55. "Ich sage euch: man muß noch Chaos in sich haben, um einen tanzenden Stern gebären zu können" (Friedrich Nietzsche, *Also Sprach Zarathustra*, prologue, sec. 5). See Otto Dix 1891–1969, exhibition catalogue (Tate Gallery, 1992), 79; and Sarah O'Brien Twouhy, "Dix and Nietzsche" in the same publication, esp. 43–45. The catalogue commentary on the portrait notes its traditional aspect, notably the three-quarter-profile pose "reminiscent of Rembrandt's *Man with the Golden Helmet*." The stars derive from the embossed bronze (or gold) fixtures on the contemporary black officer's helmet, but the expanding arcs also suggest an antique horsehair crest.
56. Quoted in Eva Karcher, *Otto Dix* (Naefels: Bonfini, 1987), 21–22, from an interview with Maria Wetzel, *Diplomatische Kurier* 14 (1965): 739.
57. Quoted in Matthias Eberle, *World War I and the Weimar Artists*, Dix, Grosz, Beckmann, Schlemmer (New Haven, Conn.: Yale University Press, 1985), from Hans Kinkel, *Vierzehn Berichte* (Stuttgart, 1967), 75. On Dix and the body, see Eva Karcher, *Eros und Tod im Werk von Otto Dix; Studien zur Geschichte des Körpers in den zwanziger Jahren* (Münster: Lit, 1984). Among the works of Urs Graf in the early sixteenth century—ex-soldier and illustrator of the mercenary's life and *Ensign-Pistol* airs—there are two remarkable drawings in the Basle Kunstmuseum Kupferstichkabinett that fit Dix's characterization particularly well. Both are reproduced in Hale, *Artists and Warfare in the Renaissance*, where Hale describes the subject of one as follows: "Armless and with a wooden leg, a young woman stands disconsolately before a lakeside village. One breast is deeply wounded; she appears to be partly blind.... The military have been sadistically in her and at her, and have moved on" (35). Cf. Dix's war mutilated in the paintings *Prager Straße* (1920) and *The Cardplayers* (1920). The other, of a battle in progress, populates the foreground with sprawled, pierced, dismembered, disemboweled corpses of men and horses, eked out with hanged peasants and a building in flames (175).
58. The denaturing of sunlight and shadow ("Sunlight seems a blood-smear; night comes blood-black"), the "hilarious, hideous" expression of the mad, like a rictus on a corpse, and the pain and "slow panic" are all to be found in Wilfred Owen's wrenching poem "Mental Cases."
59. The suppressed etching is reproduced in the Tate exhibition catalogue (1992), 155, which also quotes the appeal of the publisher, Karl Nierendorf. The face of the nun has skull-like attributes, the hint of a motif common in fifteenth- and sixteenth-century depictions of the soldier's life and echoed again in Dix's *The Triumph of Death* (1934). These symbolic overtones do not mitigate the physical realism of the scene.
60. See Keegan, *The Face of Battle*, 280, 302–305, and the superimposed scale maps (240). Keegan astutely remarks that much of the fighting in the two world wars was not "battle" as the concept has been generally understood but "siege" (303).
61. Ernst Jünger, *The Storm of Steel*, from the *Diary of a German Storm-Trooper on the Western Front*, trans. Basil Creighton (London: Chatto & Windus, 1929), 109; from *In Stahlgewittern* (Berlin, 1921).
62. This etching—"Shell Crater with Flowers (Spring 1916 near Reims)"—is close to a drawing, one of hundreds Dix made during the war, reproduced in Eberle, *World War I and the Weimar Artists*, 35. Eberle emphasizes the continuing Nietzschean play between life and decay, sex and death in Dix's postwar work and minimizes the change in "outlook" (41).
63. Keegan, *The Face of Battle*, 16.
64. Keegan, *The Face of Battle*, 57, credits the great Victorian best-seller Sir Edward Creasy's *Fifteen Decisive Battles of the World* (1851).
65. Napoleon's proclamation on the eve of Austerlitz, as incorporated into Tolstoy's *War and Peace*, trans. Louise and

Aylmer Maude, *World's Classics* ed. (London: Oxford University Press, 1970), book 3, chap. 12.

66. In a characteristic analytical meditation, "War and Representation," *PMLA* 129 (October 2009): 1532–1547, Fredric Jameson writes, "Abstraction versus sense-datum: these are the two poles of a dialectic of war, incomprehensible in their mutual isolation, which dictate dilemmas of representation navigable only by formal innovation...and not by any stable narrative convention." Nevertheless he allows the efficacy of "what I called the existential experience of war, through which an equally undefined subject or consciousness finds representation" (1547). Jameson's exploration is bounded by "the suspicion that war is ultimately unrepresentable—and by an attention to the various forms the impossible attempt to represent it have taken" (1553).
67. One such is W. G. Sebald. In *The Rings of Saturn*, trans. Michael Hulse (New York: New Directions, 1998), his protagonist visits the field of Waterloo and the Waterloo Panorama, with its immense 360-degree painting and realistic three-dimensional foreground, putting the spectator on a platform at the seeming center of events. "This then, thought, as I looked round about me, is the representation of history. It requires a falsification of perspective. We, the survivors, see everything from above, see everything at once, and still we do not know how it was" (124–125). It may be said that the contemporary historian's task and felt obligation has changed substantially in the wake of the impetus toward "history seen from below." Keegan's landmark work, *The Face of Battle*, distilled and foregrounded the recoverable experience of the soldier in the ranks, giving due credit to such predecessors as S. L. A. Marshall's *Men Against Fire* (1947) and Martin Middlebrook's *The First Day on the Somme* (1971).
68. The best known of such scenes is Antonio Pollaiuolo's study in anatomy and mayhem, known as *The Battle of the Nude Men* (ca. 1465). See also Domenico Campagnola's similarly titled engraving of 1517, illustrated in Hale, *Artists and Warfare in the Renaissance*, 162.
69. Translations are from Stendahl, *The Charterhouse of Parma*, trans. C. K. Scott Moncrieff, 2 vols. (London: Chatto and Windus, 1926). Other references are to the edition in Stendhal, *Romans et nouvelles*, vol. 2, ed. Henri Martineau, *Bibliothèque de la Pléiade* (Paris: Gallimard, 1956).
70. According to Martineau, Saint-Beuve was the first to connect Stendhal's rendering of the battle to the account in the *Journal of a Soldier of the Seventy-First or Glasgow Regiment, Highland Light Infantry*, from 1806 to 1815 (Edinburgh, 1819). Martineau says there is no evidence Stendhal knew the work, but there is no question that the soldier anticipates Stendhal "dans sa façon de raconter ce qu'il a vu, sans y rien comprendre, et sans y chercher à l'expliquer" (Stendhal, *Romans et nouvelles* [Pléiade], 1389).
71. Crane's first statement was quoted in the preface to the 1900 edition; his second appeared in a letter to John Phillips of 1895. Both are cited by J. C. Levinson, introduction to *The Red Badge of Courage* (Charlottesville: University of Virginia Press, 1975), I, lxxvii. Citations are from this edition. The battle is nameless in the novel, but in a subsequent story called "The Veteran," the protagonist, now a grandfather, tells his young grandson that he ran in his first battle and identifies it as Chancellorsville.
72. Isaiah Berlin, *The Hedgehog and the Fox: An Essay on Tolstoy's View of History* (London: Phoenix, 1992), 19–20.
73. Paul Boyer, *Chez Tolstoï; entretiens à Iasnaïa Poliana* (Paris: Institut d'Études Slaves, Univ. de Paris, 1950), 40.
74. See Levenson, introduction to *The Red Badge of Courage*, xl.
75. Berlin, ventriloquizing for Tolstoy in a passage that explores Tolstoy's attraction to Schopenhauer ( *The Hedgehog and the Fox*, 48).
76. A consciously anti-Tolstoyan account of Russian strategy, planning, organization, and success—and by implication, of war itself—may be found in Dominic Lieven's deeply researched and ably argued *Russia Against Napoleon: The Battle for Europe, 1807 to 1814* (London: Allen Lane/Penguin, 2009).
77. As did H. H. Asquith, letter of July 24, 1914, in *Letters to Venetia Stanley*, ed. Michael Brock and Eleanor Brock (Oxford: Oxford University Press, 1982), 123.
78. Filippo Tommaso Emilio Marinetti, *Guerra, sola igiene del mondo* (1915), in *Futurismo & Futurismi*, ed. Pontus Hulten (Milano: Bompiani, 1986), 487.
79. I cannot see the painting, as some have done, as representing the hopeful dawn of a new day, despite its beauty. For a convincing placement that takes account of both what belongs to a pictorial trope and to the reality of the Western Front, see Paul Gough, "The Empty Battlefield," *Imperial War Museum Review* 8 (London, 1993): 38–47. Gough cites and illustrates the attempts of other artists to enact the formlessness, the absence of organizing features, "the spatial disjunctions and temporal dislocation that governed No Man's Land" (43).
80. John Masefield, letter of March 12, 1917, in *John Masefield's Letters from the Front, 1915–1917*, ed. Peter Vansittart (London: Constable, 1984), 212.
81. Reproduced in *Otto Dix, 1891–1969* (Tate Gallery, London, 1992), no. 20 (p. 83).
82. The painting is most directly echoed in "Abandoned Emplacement near Neuville."
83. In the Tate Gallery 1992 catalogue, Keith Hartley discusses the triptych (including the predella showing sleeping soldiers in a dugout) as corresponding to a Crucifixion, the side panels offering a Road to Calvary and a Deposition (171). The layered associations of the ensemble, as an indictment enlisting Christian iconography, include an Ecce Homo implicit in the hanged man's gesture but directed at the inverted soldier. Such a charged figure leaning out

precariously over the scene had a notable place in the imagery of this war. It occurs in Owen's "A Calvary Near the Ancre" and O'Casey's *Silver Tassie* and had a basis in the famous "leaning Virgin" hanging, at an angle similar to Dix's suspended corpse, from the summit of a shot-torn church in Albert. A depiction by François Flameng (1915) appears in John Laffin, *The Western Front Illustrated, 1914–1918* (Wolfboro Falls, N.H.: Allan Sutton, 1991), opp. p. 135.

84. Henri Barbusse, *Le feu* (journal d'une escouade) (Paris: Flammarion, 1916); English translation by Fitzwater Wray (1917); German translation (Zurich, 1918). In Paul Fussell, *The Great War and Modern Memory* (London: Oxford University Press, 1975), 232, 289, Fussell notes that in December 1917 Wilfred Owen was reading a copy lent him by Siegfried Sassoon "with enthusiasm." See also Wilfred Owen, *Collected Letters*, ed. Harold Owen and John Bell (London: Oxford University Press, 1967), 520n. Except where otherwise indicated, I use the more recent translation by Robin Buss (New York: Penguin, 2003).
85. Chosen in competition 1959, dedicated 1968. A smaller replica is at the Yad Vashem Holocaust memorial in Jerusalem. An architectural approach to memorializing the event and its resistance to containment is in the Jewish Museum in Berlin, where Daniel Libeskind's "deconstructive" extension addresses the paradox experientially as well as conceptually.
86. Ernst Jünger, *The Storm of Steel*, 30.
87. Reginald Farrer, *The Void of War: Letters from Three Fronts* (London: Constable, 1918), cited in Gough, "The Empty Battlefield," 38–39, along with others voicing similar perceptions.
88. Studio Daniel Libeskind, <http://www.daniel-libeskind.com/projects/show-all/imperial-war-museum-north>.
89. Richard Cork, "Apocalypse North," (London) *Times*, July 3, 2002, 5.

## 6. ENERGY

1. Post-Renaissance Empedoclean resonances emerge, however, in Ben Jonson's poem, "A Celebration of Charis," part 4, "Her Triumph," where Charis, emanating and embodying Love, bears in her face "All the Gaine, all the Good, of the Elements strife" while Alexander Pope, justifying the order of things with its frictions and apparent imperfections in his "Essay on Man" (epistle 1, ll. 169–70), notes that "ALL subsists by elemental Strife; / And Passions are the elements of Life."
2. In his magisterial if incomplete *History of European Thought in the Nineteenth Century*, John Theodore Merz put "the growth and development of this greatest of all exact generalizations—the conception of energy" at the center of nineteenth-century scientific achievement (John Theodore Merz, *History of European Thought in the Nineteenth Century* [Edinburgh: W. Blackwood, 1904–1912; repr. New York: Dover, 1965], vol. 2, chap. 7, "On the Physical View of Nature," esp. 95–96).
3. Thomas Young is credited with introducing this formulation in his *Lectures on Natural Philosophy* (1807). See OED, s.v. "Energy 6 .a. Physics"; and Morton D. Paley, *Energy and the Imagination: A Study of the Development of Blake's Thought* (Oxford: Clarendon, 1970), 7.
4. Isaac Newton, *The Mathematical Principles of Natural Philosophy*, trans. Andrew Motte, new ed., rev. W. Davis, 3 vols. (London: H. D. Symonds, 1803), book 1, p. 14.
5. Newton, *Principles*, definition 3, book 1, p. 2. Richard S. Westfall renders this language for the resistance of matter (mass) to a change of state as "the force of inertia, or perhaps, in a free translation, the activity of inactivity. [Newton] arrived at this paradoxical conception of a matter both inert and active early in 1685 and bequeathed it to modern science as an essential part of his dynamics" (Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* [Cambridge: Cambridge University Press, 1983], 419).
6. From the remarkable set of "Queries" with which Newton concludes book 3 of the *Opticks*, ostensibly as a program for "a farther search to be made by others" (Isaac Newton, *Opticks*, 4th ed. [1730; repr. New York: Dover, 1979], qu. 21, 22, pp. 350–353). Newton's modest ten thousand years should be understood in relation to the mere six thousand years elapsed since the creation, as commonly derived from biblical chronology.
7. Newton, *Opticks*, qu. 28, p. 365.
8. Newton, *Opticks*, qu. 31, pp. 397–401.
9. Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (Cambridge, Mass.: Harvard University Press, 1957), 247.
10. Newton, *Opticks*, qu. 31, p. 402. Nevertheless, in qu. 28 Newton invokes the "Authority" of the ancient philosophers, "who made a Vacuum, and Atoms, and the Gravity of Atoms, the first Principles of their Philosophy; tacitly attributing Gravity to some other Cause than dense Matter" (369), all of which suited his views.
11. Richard Bentley, *A Confutation of Atheism from the Origin and Frame of the World* (London: H. Mortlock, 1693), part 3, pp. 27–28; reprinted in *Isaac Newton's Papers and Letters on Natural Philosophy*, ed. I. Bernard Cohen (Cambridge, 1958), 339–340. Bentley adds that to show "there is really such a Power of Gravity perpetually acting in the



constitution of the present System...would be a new and invincible Argument for the Being of God: being a direct and positive proof, that an immaterial living Mind doth inform and actuate the dead Matter, and support the Frame of the World" (341–342). In a rare flight of poetry, Newton could refer to God's presence in infinite space "as it were in his Sensory" (*Opticks*, qu. 28, 31; pp. 370, 403). But though the Newtonian cosmos was often invoked in later times as evidence of Mind in the Creation, resort to the sustaining immanence of God receded as the full ingenuity of the self-sustaining arrangements emerged.

12. Citations are from a reprint of Thomas Burnet's second edition of *Telluris Theoria Sacra* (1690–1691; Carbondale: Southern Illinois University Press, 1965). Joseph Addison addressed a Latin ode "Ad Insignissimum Virum D. Tho. Burnettum, Sacrae Theoriae Telluris Autorum"; Richard Steele in the *Spectator* 146 (August 17, 1711) pairs him with Cicero for "sublime Thoughts communicated to us by Men of great Genius and Eloquence," giving Burnet the advantage "in proportion to his Advantages of Scripture and Revelation."
13. Burnet, *Telluris Theoria Sacra*, book 1, chap. 4, p. 49.
14. He writes, "it is no detracton from Divine Providence, that the course of Nature is exact and regular, and that even in its greatest changes and revolutions it should still conspire and be prepar'd to answer the ends and purposes of the Divine Will in reference to the Moral World. This seems to me to be the great Art of Divine Providence, so to adjust the two Worlds, Humane and Natural, Material and Intellectual, as seeing through the possibilities and futuritions of each, according to the first state and circumstances he puts them under, they should all along correspond and fit one another, and especially in their great Crises and Periods" (book 1, chap. 8, p. 89).
15. Isaac Newton, *The Correspondence of Isaac Newton*, vol. 2: 1676–1687, ed. H. W. Turnbull (Cambridge: Cambridge University Press, 1960), 319–334, esp. 332–334.
16. Pierre Simon Laplace, *Exposition du système du monde*, 4th ed. (Paris, 1813), 441–442.
17. Adam Smith, "The Principles Which Lead and Direct Philosophical Enquiries; Illustrated by the History of Astronomy," in *Smith's Essays on Philosophical Subjects*, ed. W. P. D. Wightman and J. C. Bryce (Oxford: Clarendon, 1980), 66.
18. Friction affecting moving bodies was fully conceptualized only in the wake of Newton's synthesis, with the first full study on dry friction coming in 1781 from Charles-Augustin Coulomb.
19. Christopher Smart, *The Poetical Works of Christopher Smart*, vol. 1: *Jubilate Agno*, ed. Karina Williamson (Oxford: Clarendon, 1980), 43. Smart, who had read Newton attentively, came (like his successor, Blake) to an "outright rejection of Newtonian science in *Jubilate Agno*," according to Williamson, under the influence of John Hutchinson's religious critique. The opposition here is between Newtonian frictionless space and the system of nature as plenitude and plenum.
20. Mark Evan Bonds, "Haydn, Laurence Sterne, and the Origins of Musical Irony," *Journal of the American Musicological Society* 44 (Spring 1991): 58–59, points to "the repeated comparisons made during Haydn's lifetime between the composer and the English novelist Laurence Sterne." And though other literary figures were also called into service, Sterne "remains the only figure consistently associated with Haydn throughout the late eighteenth and early nineteenth centuries. It would appear, moreover, that Haydn is the only composer of his day to have been compared to this particular writer." The comparisons, both then and now, are I believe well grounded, in both artists' gift for comingling "sincere sentiment and ironic distance" (84) and in their comedic delight in flaunting formal convention, rhetoric, and expectation. But I will argue that the two works under scrutiny here, in engaging and representing versions of chaos, are more amenable to contrast than to comparison.
21. Citations from Laurence Sterne's *Tristram Shandy* are from James A. Work's excellent edition, based on the first London editions (New York: Odyssey, 1940).
22. Usually translated into English as "The Representation of Chaos," *Vorstellung* (rather than *Darstellung*) suggests something more directly presentational as well as something preliminary (a prologue) and something notional (an idea, a conception of chaos). As antecedent to what shall unfold, it connects art and the composer to cosmogenesis.
23. Claudio Monteverdi, *L'Orfeo. Favola in musica Rappresentata in Mantova l'anno 1607* (Venezia, 1609), facsimile (Florence: Studio per Edizioni Scelte, 1993), 80. The earlier libretto (Mantova: Francesco Osana, 1607) reads: "Qui si fa strepito dietro alla Scena."
24. Ben Jonson, *The Masque of Queens*, in Inigo Jones, *The Theatre of the Stuart Court*, ed. Stephen Orgel and Roy Strong (London: Sotheby Parke Bernet; Berkeley: University of California Press, 1973), 1:132–133.
25. See Joscelyn Godwin, *Harmonies of Heaven and Earth: The Spiritual Dimension of Music from Antiquity to the Avant-Garde* (London: Thames & Hudson, 1987), esp. part 3, "The Music of the Spheres," and the treatment of Kepler; and Godwin's useful anthology, *Music, Mysticism, and Magic: A Sourcebook* (London: Routledge & Keegan Paul, 1986).
26. David Hockney, "Tea with Mr. Hockney," interview by John Cornwell, *Sunday Times* (London) Magazine, October 10, 1993, 40.
27. In the twentieth century, noise comes into its own, with the Futurist Luigi Russolo, a musician by training as well as painter, announcing in 1913 "The Art of Noises" as a new music for the age of the machine (paving the way for the *musique concrète* of the mid-century); John Cage, the composer and theorist, with his Will Rogers attitude: "There is no noise, only sound. I haven't heard any sounds that I consider something I don't want to hear again"; and Jacques

Attali, the political economist, with his Mary Douglas approach: noise (like dirt, as a classification of matter) is only sound out of place, whereas “music is inscribed between noise and silence, in the space of the social codification it reveals.” On the wider scene, Jon Pareles theorizes contemporary rock and roll as “noise-tinged music,” which, if not a sufficient definition, points in the right direction. “Noise, plus a recognizable beat and a general economy of chords, adequately circumscribes rock and roll—plus or minus a few ‘honkers and shouters’ from the realm of rhythm and blues.” See Russolo’s 1913 manifesto *L’arte dei rumori*, in the exhibition catalogue *Futurism & Futurismi* (Milano: Bompiani, 1986), 565–569; Allan Kozinn’s obituary for John Cage, quoting from an interview given a month before he died, *New York Times*, August 13, 1992; Jacques Attali’s 1977 treatise *Bruits*, translated as *Noise: The Political Economy of Music* (Minneapolis: University of Minnesota Press, 1987), 19; and Jon Pareles, “Noise Evokes Modern Chaos for a Band,” *New York Times*, March 9, 1986.

28. Gottfried Wilhelm Leibniz, *Essais de Theodicée sur la bonté de Dieu, la liberté de l’homme et l’origine du mal* (1710), paras. 145 and 12.
29. Gottfried Wilhelm Leibniz, “On the Radical Origination of Things” (1697), in *Philosophical Papers and Letters*, ed. Leroy E. Loemker (Chicago: University of Chicago Press, 1956), 2:795–796.
30. B. L. Scherer writes, “Beethoven also does this in the finale of the Ninth Symphony, the great tone cluster that precipitates the rushing motive introducing the recitative for string bass and again later for bass baritone (O Freunde, nicht diese Töne). And it can be argued that this too is a reference to the chaos out of which the joy emerges” (personal communication).
31. As rendered in James R. Anthony, *French Baroque Music* (London: Batsford, 1973), 309–310. In *Les éléments*, ed. Catherine Cessac (Paris: Salabert, 1993), p. xiv, Anthony also calls attention to “the ‘chaotic’ opening chord” of the presto episode in the finale of Beethoven’s Ninth Symphony as well as to “the more restrained ‘representation of chaos’” in Haydn’s *Creation*.
32. For example, in Sir John Davies, *Orchestra, or A Poem of Dauncing* (1596), where Antinous argues:

The Fire, Ayre, Earth and Water did agree,  
By Loves perswasion, Natures mighty King,  
To leave their first disordred combating;  
And in a daunce such measure to observe,  
As all the world their motion should preserve.

(The Poems of Sir John Davies, ed. Robert Krueger [Oxford: Clarendon, 1975], 94–95)

33. See Heinrich Schenker, “The Representation of Chaos from Haydn’s *Creation*,” trans. William Drabkin, in *The Masterwork in Music: A Yearbook*, Cambridge Studies in Music Theory and Analysis (1926; repr. Cambridge: Cambridge University Press, 1996), 2:97–105.
34. F. L. A. Kunzen, in the *Zeitung für die elegante Welt* (December 22, 1801), trans. in H. C. Robbins Landon, *Haydn: The Years of “The Creation,” 1796–1800*, vol. 4 of *Haydn: Chronicle and Works* (Bloomington: Indiana University Press, 1977), 600.
35. Carl Friedrich Zelter, from the *Allgemeine musikalische Zeitung* IV (1801–1802), 390ff., trans. William Drabkin, in Schenker, *Masterwork*, 2:103.
36. Landon, *Haydn*, 356.
37. Thomas Damant Eaton, “Remarks on the ‘Creation’” (1849), in *Musical Criticism and Biography* (London: Longmans, 1872), 48.
38. Charles Rosen, *The Classical Style: Haydn, Mozart, Beethoven* (New York: Norton, 1972), 370. Rosen later adds, “By what, then, is chaos represented, and how can Haydn’s musical language express this and still remain language? Simply by the absence of clear articulation in the large phrase-groups, which merge and blend with each other, and by the withholding of clear and definite cadences.” Rosen’s account, linguistic and stylistic, is challenged in A. Peter Brown, “Haydn’s Chaos: Genesis and Genre,” *Musical Quarterly* 73 (1989): 18–59. Brown argues that the “Chaos” section mingles aspects of the older motet and more recent improvisatory styles in a *ricercar* of the exordium type and that its “language” is best understood more literally, in a tradition that assimilates musical and rhetorical practices. The essay, which also follows generative clues in the drafts, is illuminating on many of the effects, the nature of the incompletions, and the exploratory path to the emergence of retrospective resolutions. But the overdetermined potentialities inherent in the complex, irresolute, exploratory texture and progression seem to me to incorporate quite handily the elements of Rosen’s “slow-movement sonata.”
39. See, however, Elaine R. Sisman, “Haydn’s Theater Symphonies,” *Journal of the American Musicological Society* 43 (1990): 292–352, for a rich exploration of the context of Haydn’s theater involvements and their reflection in the features of a broadly dramatic (and less specifically *Sturm und Drang*) style. “*Le Distratt*” is drawn from incidental music for Regnard’s play of the same name.
40. Donald Francis Tovey, *Essays in Musical Analysis*, vol. 5: *Vocal Music* (London: Oxford University Press, 1972), 114–

41. Hermann von Helmholtz, "On the Origin of the Planetary System," in *Popular Lectures on Scientific Subjects*, 2nd ser., trans. E. Atkinson (London: Longmans, Green, 1881), 173–174, 184.
42. Robert Chambers, *Vestiges of the Natural History of Creation*, 6th ed. (London: John Churchill, 1847), 7, 17, 24.
43. The original title (1755, but the book was impounded for a decade) was *Allgemeine Naturgeschichte und Theorie des Himmels oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Wel[t]gebäudes nach Newtonischen Grundsätzen abgehandelt*. For an English version, see Kant's *Cosmogony*; as in *His Essay on the Retardation of the Rotation of the Earth and His Natural History and Theory of the Heavens*, ed. and trans. W. Hastie (Glasgow: James MacLehose, 1900; rev. ed. New York: Greenwood, 1969).
44. See Tovey, *Essays in Musical Analysis*, 5:114–115.
45. Extracts from Herschel's paper "On Nebulous Stars," properly so called, Laplace's discussion, and related matters are conveniently presented in *The Herschel Chronicle*, ed. Constance A. Lubbock (Cambridge, 1933), 226–232.
46. See the listing in Landon, Haydn, 626. In his engrossing chapters on the Herschels—father, son, and William's sister Caroline—Richard Holmes notes that Haydn "claimed that his visit to Herschel at Slough in 1792 had helped him compose his oratorio *The Creation*." Holmes also observes that some three decades earlier, Herschel himself had composed an oratorio based on Milton's *Paradise Lost*, though the score has not survived (Richard Holmes, *The Age of Wonder* [New York: Vintage, 2010], 73, 199). See also 122–124, 191–193, on Herschel's daring conjectures in the mid-1780s on the vast extent of space, on the multitudinous distant nebulae as actual galaxies or "island universes," conjectures where direct observation and Kant's speculative reasonings appear to converge in a universe of unfathomable depth and continuous creation incorporating dynamic growth and decay.
47. The translation by H. C. Robbins Landon (in Haydn, 587) encourages a nebular-genesis-influenced reading by, for example, translating "ein Schwimmen und Wallen" as "a swirling and twisting" (which would also suit Lucretian models). But even without such help, the echoes are certainly there. For the original text, see the *Allgemeine musikalische Zeitung* 3 (January 21, 1801), 291–292.
48. The word "petrific" first turns up as Death's "mace petrific" in *Paradise Lost*, used to fix the bridge through Chaos between Hell and the world.
49. Immanuel Kant, "Critique of Aesthetic Judgement," in *The Critique of Judgement*, trans. James Creed Meredith (Oxford: Clarendon, 1952), 92.
50. Johann Wolfgang von Goethe, *Faust, a Tragedy*, trans. Walter Arndt, ed. Cyrus Hamlin, Norton critical ed. (New York: Norton, 1976), 396. Such contradictions, needless to say, already hold the seed of part 2's marriage of Faust and Helen.
51. Goethe, *Faust*, trans. Arndt, II. 340–343.
52. August Wilhelm von Schlegel, *Lectures on Dramatic Art and Literature*, trans. John Black, rev. A. J. W. Morrison (London: George Bell, 1904), 343. As lectures, delivered 1808.
53. From the incomplete novel Heinrich von Ofterdingen (1802), chap. 8; in Novalis, *Schriften*, 1er Bnd. (Stuttgart: W. Kohlhammer, 1960), 286.
54. Novalis, *Schriften*, 3er Bnd., *Das philosophische Werk*, part. 2, pp. 280–281. The passage concerns romantic literature and begins with a list that includes Goethe's Wilhelm Meister and Werther.
55. Friedrich Schlegel, *Fragmente [Athenäums-Fragmente]*, 24. With others of the Jena circle including Tieck and Novalis, Schlegel published a series of philosophical fragments in the *Athenaeum*, the journal he founded with his brother August. See Sophie Thomas, *Romanticism and Visuality: Fragments, History, Spectacle* (New York: Routledge, 2008), 24.
56. Lilian Furst, *Fictions of Romantic Irony in European Narrative, 1760–1857* (London: Macmillan, 1984), 208. The phrase is "gebildetes künstliches Chaos." The notion of romantic irony is also credited to Friedrich Schlegel, along with Tieck and a few others.
57. Karl Kroeber, *British Romantic Art* (Berkeley: University of California Press, 1986), 3–4.
58. Friedrich Maximilian Klingler, *Storm and Stress*, in *Sturm und Drang*, ed. Alan C. Leidner (New York: Continuum, 1992), 125–128.
59. Schiller was honored in the same draft as Washington, Franklin, Paine, Pestalozzi, and Anacharsis Clootz (September, 1792). See G. H. Lewes, *The Life of Goethe*, 2nd ed. (London: Smith, Elder, 1864), 385.
60. Friedrich Schiller, *The Robbers*, in *Sturm und Drang*, 300. Subsequent citations from *Die Räuber* make use of the translation by F. J. Lamport in this same collection.
61. Thomas Carlyle, *The Life of Friedrich Schiller* (1825), in *Thomas Carlyle's Collected Works*, library ed. (London: Chapman and Hall, 1869–1871), 5:17.
62. Friedrich Schiller, "On the Sublime," in *Essays Aesthetical and Philosophical* (London: George Bell, 1875), 139–140. Schiller's essay was written before 1801.
63. Percy Bysshe Shelley, *The Masque of Anarchy*, in *The Complete Poetical Works of Percy Bysshe Shelley*, ed.

Thomas Hutchinson (London: Oxford University Press, 1960), stanza 9, p. 339. Shelley reverses normal masque convention in his poem, in that personifications, such as Murder, Fraud, and Hypocrisy, mask themselves as individuals—Castlereagh, Eldon, and Sidmouth.

64. Percy Bysshe Shelley, *Hellas: A Lyrical Drama*, in *The Complete Poetical Works*, prologue, ll. 105–106, and scene, ll. 46–49.
65. William Blake, *The Book of Urizen* (1794), chap. 2, para. 8.
66. Morton D. Paley, *Energy and the Imagination: A Study of the Development of Blake's Thought* (Oxford: Oxford University Press, 1970), 1–3. Paley's study traces Blake's investment in "The Sublime of Energy" and its evolution to "The Sublime of Imagination." He argues that "Blake did not so much invent a conception of energy as extend and enlarge existing ones," and he documents the considerable currency and range of the word in the eighteenth century, including the language of Neoplatonism (3–7).
67. Thomas Carlyle, *The French Revolution*, vol. 2, book 3, chap. 1. Given the abundance of available reprints, locations will be given similar form in the text. The standard edition is that of K. J. Fielding and David Sorenson (Oxford: Oxford University Press, 1989).
68. If (as can be argued) the French Revolution wrought a transformation of consciousness produced by the experience of rupture, the note Carlyle here and elsewhere sounds, with its metaphoric extension of the geophysical peril, from society to the self, would seem to reflect its legacy. The imagery recalls one of the more striking passages in Georg Büchner's *Danton's Death* (1835), written two years before Carlyle's epic, where the fear that stalks a world stretched over an abyss appears in the comedy of a pedestrian who, in the midst of commending a new play with "a Babylonian tower! A confusion of arches, stairways, passages," halts in sudden panic and asks for a hand to navigate the puddles of the street.

**FIRST GENTLEMAN:** You weren't afraid, surely?

**SECOND GENTLEMAN:** Yes, the earth is a thin crust, I always think that I could fall through, wherever there is a hole like that. You have to watch your step; you might break through.

(2.2)

69. See *Paradise Lost*, 2.890–914, 951–967.
70. A less troubled rendering of such paradoxical transposition appeared in Casimir Delavigne's celebration of the July Revolution of 1830, "Une semaine à Paris," from *Les Messéniennes—Livre III*, in *Oeuvres complètes de Casimir Delavigne* (Paris: Didier, 1855), 517). In the voice of the people, he writes: "Let order be for them, disorder is for us! / Intelligent disorder," proving to tyranny "That inspired by la patrie / A people...has its days of genius."
71. Thomas Carlyle, writing in the *Edinburgh Review* (1829), in *Carlyle's Critical and Miscellaneous Essays* (Philadelphia: A. Hart, 1852), 189.
72. Carlyle, who taught mathematics in Scotland, complains: "We have more Mathematics, certainly than ever; but less Mathesis" (*Carlyle's Critical and Miscellaneous Essays*, 190).
73. In this same essay, Carlyle remarks on how "this wondrous planet, Earth, is journeying with its fellows through infinite space" and that "For the present, as our astronomy informs us, its path lies towards Hercules, the constellation of Physical Power." *Carlyle's Critical and Miscellaneous Essays*, 196. In Alexander von Humbolt's account, William Herschel "had the great merit of being the first to verify...by actual observations (1783, 1805, and 1806)" this "translatory motion of the sun" and the entire solar system. Herschel had found, and others confirmed, "that our solar system moves toward a point in the constellation of Hercules" at an immense relative motion. Thus he opens the way to rethinking the system's inertial and gravitational stability and its position relative to the "fixed" stars in a vast field of change and velocity. See Alexander von Humbolt, *Cosmos: A Sketch of a Physical Description of the Universe*, trans. E. C. Otté (New York: Harper, 1852), 1:145–146, 3:195–196. Writing in the early 1840s, Humbolt adds that if our vision and temporal imagination were up to it, "the apparent rest that reigns in space would suddenly disappear. We should see the countless host of fixed stars moving in thronged groups in different directions; nebulae wandering through space, and becoming condensed and dissolved like cosmical clouds; the vail [sic] of the Milky Way separated and broken up in many parts, and motion ruling supreme in every portion of the vault of heaven, even as on the Earth's surface..." (1:149).
74. Thomas Carlyle, "On History," *Fraser's Magazine* (1830), in *Carlyle's Critical and Miscellaneous Essays*, 221.
75. Thomas Carlyle, "On History Again," *Fraser's Magazine* (1833), in *Carlyle's Critical and Miscellaneous Essays*, 424.
76. Carlyle, "On History Again," 425. In *The French Revolution*, Carlyle refers (with an echo of Faust's Erdgeist) to "the tissue of our Story.... faint ineffectual Emblem of that grand Miraculous Tissue, and Living Tapestry named French Revolution, which did weave itself there in very fact, 'on the loud-sounding LOOM OF TIME!'"
77. Edmund Burke, *Reflections on the Revolution in France* (1790), in *Edmund Burke, The Harvard Classics* (New York: P. F. Collier & Son, 1909), 158.



78. See Ronald Paulson's observations on Burke's use of the imagery of light, contrasting the blinding direct light of reason and the sun with the prismatic effect of its refraction and reflection through human nature (Ronald Paulson, *Representations of Revolution, 1789–1820* [New Haven, Conn.: Yale University Press, 1983], 59–60).
79. Coinage of W. J. Macquorn Rankine in a paper titled "Outlines of the Science of Energetics" (read 1855), in *Miscellaneous Scientific Papers*, ed. W. J. Millar (London: Charles Griffin, 1881), 209–228.
80. John Ruskin, *Modern Painters*, new ed., vol. 1, part 2, sec. 3, chap. 3, "Of the Truth of Clouds" (London: Smith, Elder & Co., 1873), 232–233. "His sublime Babylon is a fair example for our purposes." The watercolor drawing Ruskin describes (now in the Victoria & Albert Museum) was made for engraving in Finden's *Landscape Illustrations of the Bible* (1836) and elsewhere, from an on-site sketch by Sir Robert Ker Porter (presumably the seated artist in Turner's foreground, complete with colorful escort).
81. The painting that calls up these verses (from Shelley's "A Vision of the Sea") was *The Shipwreck* (exh. 1805). Walter Thornbury attributes the comment to "a writer in the 'Art Journal'" in his *Life of J. M. W. Turner, R.A.*, new ed. (1877; repr. London: Ward Locke, 1970), 422–423. (The style suggests the engraver and commentator John Burnet.) Shelley's strange poem of 1820 (slightly misquoted) incorporates numerous common motifs from the imagery of shipwreck and Deluge and is frequently more suggestive of Girodet or John Martin than Turner, though it shares with Turner's painting the dissolution of limits and distinctions and the imagery of the abyss and the vortex.
82. Turner's note is given in John Gage, *Color in Turner: Poetry and Truth* (New York: Praeger, 1969), 46, where Gage dates the annotated proof to late 1841. Turner's Academy lecture, from 1818, is also cited (112).
83. John Eagles, Turner's Beckmesser, wrote of his contributions to the 1842 Royal Academy: "They are like the 'Dissolving Views,' which, when one subject is melting into another, and there are but half indications of forms, and a strange blending of blues and yellows and reds, offer something infinitely better, more grand, more imaginative than the distinct purpose either view presents" (John Eagles, *Blackwood's* 52 [July 1842]: 26). For the "Dissolving Views," see Richard D. Altick, *The Shows of London* (Cambridge, Mass.: Harvard University Press, 1978), 219–220; and (in relation to Turner) Martin Meisel, *Realizations* (Princeton, N.J.: Princeton University Press, 1983), 185–186.
84. William Hazlitt, quoted in Lawrence Gowing, *Turner: Imagination and Reality* (New York: Museum of Modern Art, 1966), 13–14. For the primal-chaos analogy, see also the *Art Union* review of Turner's *Dawn of Christianity* (May 15, 1841), and E. V. Rippingille's much-noted account of Turner's habit of completing his Royal Academy pictures after they were already hung, *Art Journal* (1860): 100, quoted in Martin Butlin and Evelyn Joll, *The Paintings of J. M. W. Turner*, rev. ed. (New Haven, Conn.: Yale University Press, 1984), 1:209.
85. Thackeray, for example, while lavishing praise on *The Fighting "Temeraire"* in the Royal Academy exhibition of 1839, finds Turner's other performances there "incomprehensible" and "not a whit more natural, or less mad, than they used to be in former years, since he has forsaken nature, or attempted (like your French barbers) to embellish it." William Thackeray, "A Second Lecture on the Fine Arts," in *Miscellaneous Essays* (London: Smith, Elder, 1886), 120–121; originally *Fraser's Magazine* (June 1839). Alternatively, in a notable lecture at the Royal Institution in 1872, the distinguished ophthalmic surgeon Richard Liebreich asked, "Was the great change which made the painter of 'Crossing the Brook' afterwards produce such pictures as 'Shade and Darkness,' caused by an ocular or cerebral disturbance?" In the face of general agreement that "during the last five years of Turner's life his power of vision as well as his intellect had suffered," Liebreich's diagnosis vindicates Turner's intellect, but at the expense of his vision.
86. Hermann von Helmholtz, "On the Origins of the Planetary System," in *Popular Lectures on Scientific Subjects*, 2nd ser., trans. E. Atkinson (London: Longmans, 1881), 195.
87. Jack Lindsay, *J. M. W. Turner, His Life and Work* (New York: New York Graphic Society, 1966), 120–121, 212, 217–218; Ronald Paulson, *Literary Landscape: Turner and Constable* (New Haven, Conn.: Yale University Press, 1982), 71–73, 79–80, 98–100. W. J. T. Mitchell's wide-ranging essay "Metamorphoses of the Vortex" links Hogarth, Turner, and Blake. It appeared in *Articulate Images: The Sister Arts from Hogarth to Tennyson*, ed. Richard Wendorf (Minneapolis: University of Minnesota Press, 1983), 125–168. For Mitchell, the vortex reemerges in Turner's art as "the vast, stable, sublime form of instability itself, the image of forms, like hopes and empires, being created and destroyed" (143). Lindsay calls Turner "the first artist to be obsessed by the sense of nature as something in perpetual flux and change. He came to realize that the forms of movement were what he wanted to define, and that nature consisted, not of separate objects in mechanical relations to one another, but of fields of force."
88. An aspect of Turner's intellectual biography that John Gage brings to the fore in *J. M. W. Turner, "A Wonderful Range of Mind"* (New Haven, Conn.: Yale University Press, 1987), esp. chap. 8.
89. Michael Faraday, "A Speculation Touching Electric Conduction and the Nature of Matter," in *Great Books of the Western World*, vol. 45: Lavoisier, Fourier, Faraday (Chicago: Encyclopædia Britannica, 1952), 850–855. The essay-epistle first appeared in print in 1844. The view of atoms as centers of force, as opposed to volumetric particles of matter in which powers reside, Faraday associates with the "point atoms" of the eighteenth-century Jesuit scientist Roger Joseph Boscovich.
90. See the introduction to Helmholtz's treatise *Über die Erhaltung der Kraft* (Berlin, 1847), translated in *Scientific Memoirs Selected from the Transactions of Foreign Academies of Science etc.*, ed. John Tyndall and William Francis (London, 1853). Helmholtz argues that it would be as erroneous to define matter as existing apart from force as to define force

as existing without a basis in matter. "Both, on the contrary, are abstractions from the actual, formed in precisely similar ways. Matter is only discernible by its forces, and not by itself."

91. Quoted from a paper of 1852 in L. Pearce Williams, *Michael Faraday: A Biography* (New York: Simon & Schuster, 1971), 450.
92. See Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge University Press, 1989): "To capture the sense of space filled with forces in which objects moved between places of differential strength, Faraday introduced the term 'field' in his November, 1845, *Researches*. This terminology and the effects it connoted provided the specific incentive for Thomson [later, Kelvin] to extend his own derivation, from April, 1845, of the motive force between electrical conductors. From the confluence of their two modes of analysis came the basic tenets of classical field theory" (261). It was Kelvin who postulated vortical atoms. See also L. Pearce Williams, *Michael Faraday*, notably chap. 10, "The Origins of Field Theory," and the epilogue, 509–513.
93. Williams, *Michael Faraday*, 60–64. For an alternative account of what shaped Faraday's thought most profoundly, see Geoffrey Cantor, *Michael Faraday: Sandemanian and Scientist; A Study of Science and Religion in the Nineteenth Century* (New York: St. Martin's, 1991).
94. Proposition 1 of Immanuel Kant, *The Metaphysical Foundations of Natural Science* (1786). The existence of matter apart from the forces of attraction and repulsion he thought inconceivable. Kant's scientific and aesthetic thought fostered the Romantic *Naturphilosophie* developed most vigorously by Friedrich Schelling, whom Coleridge absorbed and retailed by the yard. Its influence on later British science and art (discernible, for example, in the writings of Charles Lock Eastlake, P.R.A.) was until recently underestimated.
95. See Lindsay's comments on Turner's annotated copy of Goethe's *Theory of Colours* (C. L. Eastlake's translation). John Gage, in *Color in Turner: Poetry and Truth* (New York: Praeger, 1969), 113, observes that "for all his opposition to the exaggerated claims of theory, Turner seems to have wanted to make a distinction between rules, about which he had severe reservations, and science, of which he fully approved." Gage later speaks of Turner's "symbolic scientism," in contrast to the plainer naturalism of the main trend in English landscape painting (189).
96. Gage, J. M. W. Turner, 225, citing the recollections of Faraday's painter brother-in-law, George Barnard, in H. Bence Jones, *The Life and Letters of Faraday* (London: Longmans, Green, 1870), 1:420.
97. "I frequently went to Turner's studio and was always welcomed. No one could imagine that so much poetical feeling existed in so rough an exterior" (Mary Somerville, *Personal Recollections from Early Life to Old Age* [Boston: Roberts, 1876; repr. New York: AMS, 1975], 269). Mrs. Somerville was a talented amateur painter.
98. A list of the books in Turner's library may be found in Bernard Falk, *Turner the Painter: His Hidden Life* (London: Hutchinson, 1938), appendix 1.
99. Gage, *Color in Turner*, 224–225. Gage interprets the longer passage he here cites as pointing to "the inescapable limitations of scientific method," whereas it appears to me to be merely cautioning against judgments based on simple perception—the "fallacy" of taking our senses literally. From the evidence on Faraday's reading and commentary before publication, Elizabeth Chambers Patterson, in *Mary Somerville and the Cultivation of Science, 1815–1840* (Boston: Martinus Nijhoff, 1983), 135, concludes that *On the Connexion* "represents Faraday's actual views at the time it was published" and that subsequent revisions maintained this state of affairs.
100. J. F. W. Herschel in the *Quarterly Review* 47 (July 1832): 547–548, 550. Somerville's exposition of the heavenly mechanism incorporates the Lagrange/Laplace demonstration of a stability underlying orbital perturbations, which—as she later wrote—"are only the oscillations of that immense pendulum of Eternity which beats centuries as ours beats seconds" (*Personal Recollections*, 182). She discovers therein a "law of equilibrium" that also accommodates the terrestrial phenomena of axial precession and libration and tidal oscillation, while the heavens, she declares, "impress the mind with some notion of the energy that maintains them in their motions with a durability to which we can see no limit" (Herschel, in the *Quarterly Review*, 551). Such eternal security was soon shaken, however, by Encke's demonstration of decay in the period of the comet that bears his name (see Smith and Wise, *Energy and Empire*, 91) and in any case had already to compete with models whose message was ceaseless activity and endless change.
101. Mayall's recollections appear in Thornbury, *Life of J. M. W. Turner*, 349.
102. Gage, J. M. W. Turner, 225. In *Turner and the Scientists* (London: Tate Gallery, 1998), James Hamilton elucidates the convergence of Davy's interests and visionary response to nature and Turner's, and their likely social interactions, notably in Rome (65–68). He substantiates further Turner's links with Mary Somerville (68–69).
103. Williams, *Michael Faraday*, 59.
104. Williams, *Michael Faraday*, 84.
105. Gage, *Color in Turner*, 117; Michel Serres, "Turner Translates Carnot," in *Hermes: Literature, Science, Philosophy*, trans. and ed. J. V. Harari and D. F. Bell (Baltimore, Md.: Johns Hopkins University Press, 1982).
106. Thornbury, *Life of J. M. W. Turner*, 462. In calling attention to such division as a Turner trademark, setting him apart from common and indeed orthodox practice, Burnet gives contemporary grounding to Serres's brilliant delineation of

- Turner as “the first true genius of thermodynamics” (“Turner Translates Carnot,” 57).
107. John Gage notes the phrase “fallacious hope” in Turner’s favorite poet, James Thomson (“Autumn,” l. 1258) and also the then common phrase for optical illusions, “fallacies of vision,” which Turner adopted in his lectures (*Color in Turner*, 106, 248n.). A more direct cultural source for both Turner and Thomson, however, would have been the familiar Ciceronian ejaculation “O, fallacem hominum spem!” (*De Oratore* 3.7). Additionally, there was Thomas Campbell’s immensely popular *Pleasures of Hope* (1799) to engage by way of contradiction.
  108. Quoted in Martin Butlin and Evelyn Joll, *The Paintings of J. M. W. Turner*, rev. ed., 2 vols. (New Haven, Conn.: Yale University Press, 1984), cat. no. 109.
  109. It is in relation to this painting that James Hamilton argues, drawing on Somerville and Faraday, that “Turner is giving graphic expression to the very real lines of force that his scientist friends had showed were being emitted from all points of the earth’s surface at all times” (*Turner and the Scientists*, 128).
  110. Ruskin, *Modern Painters*, vol. 1, part 2, sec. 5, chap. 3. Ruskin later declared, “The whole of this was written merely to show the meaning of Turner’s picture of the steamer in distress, throwing up signals.” See *The Works of John Ruskin*, ed. E. T. Cook and Alexander Wedderburn (London: George Allen, 1903–1912), 3:570n. Hopkins’s “Wreck of the *Deutschland*” (written after that 1875 event) comes closest to matching Turner in word-painting. In the poem, he evokes rocket and lightship and “the hurling and horrible airs,” “the cobbled foam-fleece,” “the burl of the fountains of air, buck and the flood of the wave,” while “Wiry and white-fiery and whirlwind-swivellèd snow / Spins to the widow-making unchilding unfathering deeps” (stanzas 13–16).
  111. Mitchell, “Metamorphoses of the Vortex,” 142.
  112. Quoted and discussed in Lindsay, *Turner*, 114, 235n. Charles Lock Eastlake, later P.R.A. and a much more conventional painter, speaks about the circle of viewers and actors and the inclusion of the viewer in the scene (with examples): “When the spectator stands before a semicircular composition of figures he may be said to complete the circle himself” (Eastlake, *Contributions to the Literature of the Fine Arts* [London: John Murray, 1848], 1:140).
  113. Gage’s suggestion, with the sun “consuming the port of Carthage,” appears in *Color in Turner*, 143.
  114. The case for a Regulus figure that appears in the painting is put by Andrew Wilton in *Turner and the Sublime*, exhibition catalogue (London: British Museum, 1980), where he reproduces Daniel Wilson’s 1840 engraving. Wilton, however, locates the scene of departure as Rome, at the start of the return journey, a reading that neither the engraving’s title—“Ancient Carthage”—nor Turner’s laconic “Regulus” supports. Nevertheless, Ruskin, *Notes on the Turner Gallery at Marlborough House 1856–71*, 2nd ed. (London: Smith, Elder, 1857)—some years after Turner’s death—calls the painting “Regulus Leaving Rome (1837).” Though I think the evidence supports Carthage and a virtual Regulus, Turner’s opening a space for ambiguity would have been encouraged by earlier dramatic, operatic, and pictorial versions of the story. In Hannah More’s now forgotten tragedy *The Inflexible Captive* (1774), “a pretty close imitation,” she says, “of the ‘Attilio Regolo’ of Metastasio” (1740; music by Hasse, 1750), the relevant closing scene is described as “within sight of the Tiber—Ships ready for the embarkation of Regulus and the [Carthaginian] Ambassador—Tribune and People stopping up the passage—Consul and Lictors endeavouring to clear it.” Persuaded by the arguments of honor and patriotism, the Roman crowd clears the way, and Regulus “departs to the ships” (*The Miscellaneous Works of Hannah More* [London: Thomas Tegg, 1840], 15n., 53, 56). At one point in the Metastasio original (3.9), while appealing to the Romans to allow him to follow the path of glory, Regolo intones, “Ah m’apre il Cielo una splendida via...” (“Ah, Heaven opens a splendid [shining] way for me”).
  115. Quoted in Gage, *Color in Turner*, 169; and Butlin and Joll, *The Paintings of J. M. W. Turner*, no. 294.
  116. The Spectator, quoted in Butlin and Joll, *The Paintings of J. M. W. Turner*. Ruskin—missing the point, I believe—thought the picture “very disgraceful to Turner.... The great fault is the confusion of the radiation of light from the sun with its reflection” (*Notes*, 60).
  117. “Hope, Hope, fallacious Hope! / Where is thy market now?”
  118. Butlin and Joll, *The Paintings of J. M. W. Turner*, 1:298.
  119. Smith and Wise, *Energy and Empire*, 261.
  120. Thomas K. Simpson, “Maxwell’s Treatise and the Restoration of the Cosmos,” in *The Great Ideas Today* (Chicago: Encyclopædia Britannica, 1986), 220.
  121. See Robert K. Wallace’s appropriately obsessive *Melville and Turner: Spheres of Love and Fright* (Athens: University of Georgia Press, 1992). Wallace cites Melville’s note in his copy of Thomas Beale’s *Natural History of the Sperm Whale*, “Turner’s pictures of whalers were suggested by this book.” He acknowledges there is no mention of Turner in the otherwise encyclopedic *Moby-Dick*, “But his artistic signature is present throughout—from Ishmael’s prelude encounter with the painting in the Spouter-Inn to Captain Ahab’s conclusive encounter with the white whale” (1). Thackeray’s review in *Frazer’s Magazine* (June 1845), suggesting how, on study, a Turner painting begins to mesmerize the viewer until one begins to see things—“that is not a smear of purple you see yonder, but a beautiful whale,” etc.—is, as Wallace notes, particularly close to Ishmael’s experience (325). Wallace gives great emphasis to the centrality of the vortex in the novel, discursively, structurally, and in the catastrophic and saving events.
  122. Lawrence Gowing, *Turner: Imagination and Reality* (New York: Museum of Modern Art, 1966), 21. In that same quoted

lecture Turner seems to suggest the immortality of those versified “lost forms each in prismatic guise.” He declares: “These attempts to define the powers of light and shade upon such changing surfaces as transparent bodies is like picking grains of sand to measure time.” Where “these bodies are supposed to be surrounded with others the innumerable rays reflected and refracted together with the resemblance of each form...make a continuation of light, color, and reflexies” (British Library, add. mss. 46151H, “Reflection and Colour”).

123. Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (New York: Harper & Row, 1962), 63.
124. John Theodore Merz, *A History of European Thought in the Nineteenth Century* (Edinburgh, London, and Chicago, 1912), 2:137.
125. Filiation between the Futurist agenda and related movements like Constructivism and Vorticism, as well as with aspects of industrial design, is readily traceable. In Russia, Liubov Popova (who had encountered Futurism in Italy) adumbrated a constructionist aesthetic based on “energies,” in such formulas as “Construction in painting = the sum of the energy of its parts” and “Energetics = direction of volumes + planes and lines or their vestiges + all colours.” See John E. Bowlit, “Russian Formalism and the Visual Arts,” in *Russian Formalism*, ed. Stephen Braun and John Bowlit (Edinburgh, 1973), 141–142.
126. See Henry Adams, *The Education of Henry Adams* (written 1905; published 1907), chap. 25, “The Dynamo and the Virgin.” Adams’s late argument for adapting the second law of thermodynamics to a theory of history may be found in the posthumously published volume *The Degradation of the Democratic Dogma* (New York: Macmillan, 1919).
127. Henri Bergson, *Creative Evolution*, trans. Arthur Mitchell (New York: Henry Holt & Co., 1911), 302–308.
128. Filippo Tommaso Marinetti, “La futurisme,” *Le Figaro* (Paris) (February 20, 1909); trans. R. W. Flint, in *Futurist Manifestos*, ed. Umberto Apollonio (London: Thames and Hudson, 1973), 21–23.
129. “Futurist Paintings Technical Manifesto,” in *Futurist Manifestos*, 27.
130. “The Exhibitors to the Public 1912,” in *Futurist Manifestos*, 48.
131. *Futurist Manifestos*, 63.
132. In the grand catalogue *Futurismo & Futurismi*, for the Palazzo Grassi, Venice, exhibition (Milano: Bompiani, 1986), Maurizio Calvesi reads the painting somewhat differently, as departing from a Bergsonian antinomy of matter and movement and instead bringing both under the mediating principle of energy (430).



## 7. ENTROPY

1. See Newton's *Opticks* (New York: Dover, 1979), 400–401, on the “primitive Particles.”
2. Thomas Kuhn, “Energy Conservation as an Example of Simultaneous Discovery,” in *The Essential Tension* (Chicago: University of Chicago Press, 1977), 69. Reprinted from *Critical Problems in the History of Science*, ed. Marshall Clagett (1959).
3. James Prescott Joule, *The Scientific Papers of James Prescott Joule* (London, 1884), 1:271, 273.
4. J. R. Mayer (1842), who in 1841 had proposed the indestructibility of “force”; as quoted in Martin Goldstein and Inge F. Goldstein, *The Refrigerator and the Universe* (Cambridge, Mass.: Harvard University Press, 1993), 63. Joule and Mayer were the focus of a bitter priority argument later in the century. For an incisive account that sets the bumpy development of energy physics in its wider societal and institutional contexts, see Crosbie Smith, *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (Chicago: University of Chicago, 1998).
5. The substitution of Conservative for Tory in the party name was in fact first proposed in 1830 by John Wilson Croker in the *Quarterly Review* (OED) and seems to have entered common use before Peel's notable declaration of principle in 1834. A much repeated story concerning the earlier ministry of Lord Liverpool (1812–1827) cites the remark of a witty French critic: that had the said statesman been present at the Creation, he would have cried out, “Mon Dieu, conservons le Chaos!” Such a sally, but referring only to “the good folk who would like to keep all things as they are,” appears in a polemic of 1819 by the French pamphleteer Paul-Louis Courier.
6. Charles Brunold, *L'entropie: son rôle dans le développement historique de la thermodynamique* (Paris: Masson, 1930), 137.
7. Hermann von Helmholtz, *Popular Lectures on Scientific Subjects*, 2nd ser., trans. E. Atkinson (London: Longmans, 1881), 177–178.
8. Ernst Mach, in an 1894 partial reprise of his treatise, *Ueber die Erhaltung der Arbeit* (“On the Conservation of Work,” Prague, 1872), in *Popular Scientific Lectures*, 5th ed., trans. Thomas J. McCormack (LaSalle, Ill.: Open Court, 1943), 177–178. Mach here speaks of the modern conception of energy as a useful formalism and scoffs at such expressions as “energy of the world” and “entropy of the world” (the universe) as “slightly permeated with scholasticism.”
9. “Die Energie des Welt ist constant; die Entropie strebt einer Maximum zu.” The term and its epigrammatic formulation both appear in a paper of 1865, but the concept had been developed in papers of the early 1850s, notably Rudolf Clausius, *Ueber eine veränderte Form des zweiten Hauptsatzes der mechanischen Wärmetheorie* (1854).
10. In *Reflections on the Motive Power of Fire by Sadi Carnot and Other Papers on the Second Law of Thermodynamics* by E. Clapeyron and R. Clausius, ed. E. Mendoza (New York: Dover, 1960).
11. Helmholtz, in a memoir on the thermodynamics of chemical processes, 1882; quoted in John Theodore Merz, *A History of European Thought in the Nineteenth Century* (Edinburgh: Blackwood, 1904–1912; repr. New York: Dover, 1965), 182n.
12. Charles H. Bennett, “Demons, Engines, and the Second Law,” *Scientific American* 257 (November 1987): 108.
13. Sir William Thomson, *Mathematical and Physical Papers* (Cambridge: Cambridge University Press, 1882), 1:511–514. Reprinted from the “Proceedings” for April 19, 1852, and the *Philosophical Magazine* 4 (October 1852): 304–306.
14. W. J. Maquorn Rankine, “On the Reconcentration of the Mechanical Energy of the Universe,” read in Belfast before the British Association, September 2, 1852. Published in the *Philosophical Magazine* (November 1852) and in his *Miscellaneous Scientific Papers* (London: Charles Griffin, 1881), 200–202. Rankine would make notable contributions to energy theory, including the distinction between “potential energy” (his coinage) and “actual energy” (soon rechristened “kinetic”). His “thermodynamic function,” a measure of transformation, has much in common with Clausius's “entropy.”
15. Rankine, *Miscellaneous Scientific Papers*, 226–227. The science Rankine here names “Energetics” developed into a powerful view on the nature of physical reality later in the century, with consequences in Einstein's mass-energy equation.
16. Hermann von Helmholtz, “On the Interaction of Natural Forces,” trans. John Tyndall, in *Popular Scientific Lectures*, ed. Morris Kline (New York: Dover, 1962), 74. From a lecture delivered in Königsberg (February 7, 1854), commemorating Immanuel Kant.
17. Rudolf Clausius, “On the Second Fundamental Theorem of the Mechanical Theory of Heat,” *Philosophical Magazine*, ser. 4, 35 (June 1868): 417–419. From a lecture delivered at Frankfurt, September 23, 1867. The bleak power of an inexorable death of the universe inscribed in its fundamental physical laws has never quite faded from science or imagination, though the writ and run of the second law has been more than once challenged (e.g., by Karl Popper, in “Irreversibility; or, Entropy Since 1905,” *British Journal for the Philosophy of Science* 8 [1957]: 151–155) and sometimes been effectively sidelined by aspects of contemporary speculative cosmology. For a thorough, conscientious attempt to take account of later knowledge (as of the end of the twentieth century), embracing astrophysics, particle physics, and possible scenarios under a “closed,” “nearly flat,” and “open” universe, see Fred

- C. Adams and Gregory Laughlin, "A Dying Universe: The Long-Term Fate and Evolution of Astrophysical Objects," *Reviews of Modern Physics* 69 (April 1997): 337–372.
18. From Epicurus's own summary of his doctrine, as given by Diogenes Laertius, *Lives of Eminent Philosophers*, trans. R. D. Hicks, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1970), 2:571–572 (book 10, chap. 2). Diogenes reports the story that Epicurus "turned to philosophy in disgust at the schoolmasters who could not tell him the meaning of 'chaos' in Hesiod" (531–532).
19. Benjamin Franklin, *The Papers of Benjamin Franklin*, ed. Claude A. Lopez et al. (New Haven, Conn.: Yale University Press, 1988), 27:433–435. Franklin first published the piece, dated September 20, 1778, from his own press at Passy in French translation. It appears (finely illustrated) as "Dernière paroles d'un éphémère" in Grandville's *Scènes de la vie privée et publique des animaux* (1842).
20. See Jacques Roger, *Buffon: A Life in Natural History*, trans. Sarah Lucille Bonnefoi, ed. L. Pierce Williams (Ithaca, N.Y.: Cornell University Press, 1997), 386–387, summarizing Buffon's "First View of Nature" (1764).
21. From the abridged translation of Georges Louis Leclerc, Comte de Buffon, *The Epochs of Nature*, in *Natural History, General and Particular*, by the Count de Buffon, trans. William Smellie, new ed. (London: T. Cadell and W. Davies, 1812), 2:210, 2:337. Buffon had calculated the rate of dissipation for the internal heat of the earth and other planetary bodies in his *History of Minerals* of 1774 ("Partie hypothèque. Premier mémoire. Recherches sur le refroidissement de la terre et des planètes"). In his evolved scenario, it was the cooling of the earth, rather than any diminution of the sun, that would bring on its eventual refrigeration, by which time a larger planet such as Jupiter would have cooled into habitability.
22. See A. M. D. Hughes, *The Nascent Mind of Shelley* (Oxford: Clarendon Press, 1947), 228. The prose passage is from a letter to Thomas Love Peacock (July 24, 1816).
23. Byron's debt here to the end of the *Dunciad* is evident. Robert M. Adams connects the poem, via Shelley, to Buffon's projection of progressive glaciation (Robert M. Adams, *Nil: Episodes in the Literary Conquest of the Void During the Nineteenth Century* [New York: Oxford University Press, 1966], 201). However, the immediate suggestion for the poem (dated July 1816) is likely to have been the worldwide effects of the eruption of Mount Tambora in Indonesia in 1815, which gave Europe in 1816 the coldest summer on record and produced crop failures everywhere. See Henry and Elizabeth Stommel, "The Year Without a Summer," *Scientific American* 240 (June 1979): 176–186. The poem is invoked for its inspired prescience in Tom Stoppard's split-time masterpiece, *Arcadia* (1993), where entropy and its future scientific palliative, complexity (also called "Chaos"), capture the imagination of some of his early nineteenth-century characters.
24. Constantin-François Volney, *Les ruines, ou méditation sur les révolutions des empires* (1791).
25. It is no accident, however, that her earlier *Frankenstein* is set in an Arctic landscape and owes its genesis to that same Alpine summer (1816) that stimulated Byron's poem and Percy Shelley's musings.
26. In Britain, there were six editions in two translations between 1813 and 1829. Cuvier gave a later version of this introductory treatise separate publication in France, as *Discours sur les révolutions de la surface du globe* (Paris, 1822).
27. George Gordon, Lord Byron, *Cain: A Mystery*, 2.2.285–289, in *The Complete Poetical Works of Byron*, ed. Paul E. More, Cambridge ed. (Boston: Houghton Mifflin, 1933), 640. Byron's complex ironies—lost in the scandal *Cain* evoked—are given their due in Ralph O'Connor's wide-ranging *The Earth on Show: Fossils and the Poetics of Popular Science, 1802–1856* (Chicago: University of Chicago Press, 2007), 102–104. O'Connor explores the ferment of geological argument and exposition during the half-century and its expression in a plethora of textual and spectacular popular vehicles.
28. William Whewell, writing in the *Quarterly Review* 47 (March 1832): 126. Whewell is reviewing the second volume. For a comprehensive account of the developments in geology as a science during this period and, notably, its reshaping as a historical discipline, see Martin J. S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005); and his *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform* (Chicago: University of Chicago Press, 2008).
29. Thomas H. Huxley, "The Progress of Science 1837–1887," in *Method and Results* (London: Macmillan, 1893), 98.
30. Georges Cuvier, *Essay on the Theory of the Earth*, 3rd ed. (Edinburgh: Blackwood, 1817), 3–4.
31. Both passages quoted from Hutton's *The Theory of the Earth* (1795) in Thomas H. Huxley's presidential address to the Geological Society (1869), "Geological Reform," in *Lay Sermons, Addresses, and Reviews* (London: Macmillan, 1870), 254, 255.
32. William Thompson, in *Macmillan's Magazine* 5 (March 1862): 388–393.
33. Darwin had already dropped the passage on the denudation of the Weald with its estimates (from chapter 9 of *On the Origin of Species*) in his third edition (1861), having been convinced of its inaccuracies by an article in the *Saturday Review* (December 24, 1859). Thereafter he took care to let others argue the details on the temporal parameters.
34. The role played by Thomson's religion in shaping his science is fertile ground for argument. In their incisive and authoritative biographical study, *Energy and Empire* (Cambridge: Cambridge University Press, 1989), Crosbie Smith

and M. Norton Wise establish its importance in Thomson/Kelvin's mind and thought, and in his separate study, *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (Chicago: University of Chicago Press, 1998), Crosbie Smith further argues that the formative climate of Presbyterian religion, Clydeside marine engineering, and an ingrained antipathy to waste operated decisively among the heavily Scottish, status-conscious cluster of scientists—led by Thomson—who developed thermodynamic theory in Britain. It is certainly plausible that, for example, a Calvinist rigor infused Thomson's formulation of the first and second laws and the predestinate trajectory implied in the second, and it is more or less evident that his antipathy to mindless process as opposed to purposeful order roused his combative instincts in the face of Darwinian naturalism. Nevertheless, Thomson rarely appealed to principles or beliefs external to the structures of science in his published work and insisted on the integral and indeed preemptive authority of scientific reasoning.

35. William Thomson, Baron Kelvin, *Mathematical and Physical Papers* (London: Cambridge University Press, 1890), 3:295–311.
36. William Thomson, Baron Kelvin, *Popular Lectures and Addresses* (London: Macmillan, 1894), 2:10–72. In the interval, Thomson had read a note to the Royal Society of Edinburgh (December 18, 1865) titled “The ‘Doctrine of Uniformity’ in Geology Briefly Refuted,” using the heat lost from the earth.
37. Huxley, *Lay Sermons, Addresses, and Reviews*, 251–279.
38. William Thomson, Baron Kelvin, “Of Geological Dynamics,” in *Popular Lectures and Addresses*, 2:73–113.
39. William Thomson, Baron Kelvin, *Mathematical and Physical Papers* (Cambridge: Cambridge University Press, 1911), 5:213, 5:215.
40. William Thomson, Baron Kelvin, “On the Sun's Heat” (1887), in *Popular Lectures and Addresses*, 1:390.
41. Charles Darwin, *The Autobiography of Charles Darwin, 1809–1882*, ed. Nora Barlow (London: Collins, 1958), 92 (written 1876; first published 1887). For an overview both compact and wide ranging, including many of the matters pursued above, see Stephen G. Brush, “The Nebular Hypothesis and the Evolutionary World View,” *History of Science* 25 (1987): 245–278. The best account of Kelvin's intervention is Joe D. Burchfield, *Lord Kelvin and the Age of the Earth* (New York: Science History Publications, 1975; repr. Chicago: University of Chicago Press, 1990). Burchfield underlines Kelvin's accomplishment—that is, his positive effect on geology and geologists of the next generation with respect to quantitative method and reduced parochialism.
42. Robert Chambers, *Vestiges of the Natural History of Creation*, 6th ed. (London: John Churchill, 1847), 31, 34.
43. J. P. Nichol, *Thoughts on Some Important Points Relating to the System of the World* (Edinburgh: William Tait, 1846), 226–227.
44. J. P. Nichol, *The Architecture of the Heavens*, 9th ed. (London: Hippolyte Bailliere, 1851), ix, 217. The original *Views of the Architecture of the Heavens* appeared in 1838. John Pringle Nichol is the central figure in Simon Schaffer's penetrating “The Nebular Hypothesis and the Science of Progress,” which sets him and the science that was used to promote and resist progressive views deep in the confluence of the political and intellectual currents of the time: Simon Schaffer, “The Nebular Hypothesis and the Science of Progress,” in *History, Humanity and Evolution: Essays for John C. Greene*, ed. James R. Moore (Cambridge: Cambridge University Press, 1989), 131–164.
45. Herbert Spencer, “Progress: Its Law and Cause,” *Westminster Review*, n.s., 9 (April 1857): 445–485.
46. At about this time, Spencer came to prefer the term “evolution” to “progress.” Many years later, he took credit for introducing “evolution” in its generalized modern sense “from the perception that ‘progress’ has an anthropocentric meaning, and that there needed a word free from that.” See David Duncan, *The Life and Letters of Herbert Spencer* (London: Methuen, 1908), 551n.
47. Duncan, Herbert Spencer, 104. Gillian Beer cites the passage in her masterful essay on “Wave Theory and the Rise of Literary Modernism,” in *Open Fields: Science in Cultural Encounter* (Oxford: Clarendon, 1996), 299–300. The dating (turn of 1858–1859) is Duncan's; the letter itself suggests a time when *First Principles* was largely in draft. Spencer's later account of his intellectual development, called “The Filiation of Ideas,” gives Tyndall credit for stimulating much more of what the “Progress” essay had left unthought: “It needed only to ask the question, however, to bring the inevitable answer, and the chapter on ‘Equilibration’ was the result. And then, in pursuance of the same line of thought, embodying itself in the question—‘What happens after equilibration is completed?’ there came the reply, ‘Dissolution.’ This was at once recognized as complementary to Evolution, and similarly universal” (555).
48. Spencer to his father; cited in Duncan, Herbert Spencer, 103.
49. Herbert Spencer, *First Principles* (London: Williams and Norgate, 1862), 441.
50. “The processes thus everywhere in antagonism, and everywhere gaining now a temporary and now a more or less permanent triumph the one over the other, we call Evolution and Dissolution. Evolution under its simplest and most general aspect is the integration of matter and concomitant dissipation of motion; while Dissolution is the absorption of motion and concomitant disintegration of matter” (Spencer, *First Principles*, 2nd ed. [1867], chap. 12, § 97).
51. See his letter to Tyndall, March 24, 1875, in Duncan, Herbert Spencer, 175–176.
52. Thomas H. Huxley, *Method and Results, Collected Essays*, 1:94; reprinted from *The Reign of Queen Victoria: A Survey of Fifty Years of Progress*, ed. Thomas Humphrey Ward (London: Smith, Elder. & Co., 1887), 2:322–387.

Later in the essay, Huxley notes that “attempts have been made, by the help of deductions from the data of physics, to lay down an approximate limit to the number of millions of years which have elapsed since the earth was habitable by living beings. If the conclusions thus reached should stand the test of further investigation, they will undoubtedly be very valuable. But, whether true or false, they can have no influence upon the doctrine of evolution in its application to living organisms” (2:361, 2:366).

53. Thomas H. Huxley, preface to *Evolution and Ethics and Other Essays*, *Collected Essays* (London: Macmillan, 1903), 9:viii. For the personal and public contexts, see Adrian Desmond, *Huxley: Evolution's High Priest* (London: Michael Joseph, 1997), 176–179. Desmond describes the published version, in *Nineteenth Century* (January 1888): 194–236, as much toned down.
54. Thomas H. Huxley, “The Struggle for Existence in Human Society,” in *Evolution and Ethics*, 9:198–199.
55. E. Ray Lankester, *Degeneration* (London: Macmillan, 1880). Originally delivered before the British Association at Sheffield, August 22, 1879.
56. Lankester cites Dohrn's *Der Ursprung der Wirbelthiere und das Princip des Functionswechsels* (Leipzig, 1875). Lankester notes that parasitical forms had long been recognized as instances of degeneration, or “retrospective metamorphosis,” but that the phenomenon had not been taken into account in broader views of evolutionary processes. The Victorian lesson that he reads in parasitism is the danger of the easy life: “Any new set of conditions occurring to an animal which render its food and safety very easily attained, seem to lead as a rule to Degeneration” (*Degeneration*, 33).
57. See Morel's *Traité des dégénérescences physiques, intellectuelles et morales de l'espèce humain* (1857) and Lombroso's *L'uomo delinquente in rapporto all'Antropologia, alla Giurisprudenza ed alle Discipline carcerarie* (1875).
58. Headlong Hall, in *The Works of Thomas Love Peacock*, ed. Henry Cole (London: Bentley, 1875), 1:6–7. Escot dismisses the vast modern improvements in transportation, manufacture, and all the arts of life adduced by his perfectabilist interlocutor as “only so many links in the great chain of corruption, which will soon fetter the whole human race in irreparable slavery and incurable wretchedness” (4). Peacock is not unsympathetic with this view. In a preface of 1837, for example, he refers to “the march of mechanics, which some facetiously call the march of intellect” (vi).
59. On Huxley, Wells wrote (in 1901) about “how one felt for our dean—we read his speeches, we borrowed the books he wrote.” In sum, “I believed then he was the greatest man I was ever likely to meet, and I believe that all the more firmly today” (cited in David C. Smith, *H. G. Wells: Desperately Mortal; A Biography* [New Haven, Conn.: Yale University Press, 1986], 11). Lankester was supposed to have been the model for Wells's affectionately rendered Sir Roderick Dover, a wholly unreconstructed masculinist, in the novel *Marriage*.
60. David C. Smith states, “ultimately, the book was written for T. H. Huxley,” and he quotes Wells's diffident letter of presentation: “The central idea—of degeneration following security—was the outcome of a certain amount of biological study.... I was one of your pupils at the Royal College of Science” (Smith, Wells, 46). Peter J. Bowler suggests that the Eloi's asexuality and childlike qualities illustrate a recapitulationist model for degeneration as arrested development (ontogeny halted at an earlier phase), a model Lankester had found useful. Nevertheless, the Time Traveler notes in one of Wells's earlier versions that the children of the (unnamed) Eloi seem livelier than the full-grown form, as in Lankester's Ascidian analogy. (Peter J. Bowler, “National Observer Time Machine,” reprinted in *The Definitive Time Machine*, ed. Harry M. Geduld [Bloomington: Indiana University Press, 1987], 165). See Bowler's overview, “Holding Your Head Up High: Degeneration and Orthogenesis in Theories of Human Evolution,” in *History, Humanity, and Evolution: Essays for John C. Greene*, ed. James R. Moore (Cambridge: Cambridge University Press, 1989), 337.
61. H. G. Wells, *The Time Machine*, *Works of H. G. Wells*, Atlantic ed. (London: Fisher Unwin, 1924), 1:103–110.
62. In H. G. Wells, *Certain Personal Matters* (London: Lawrence & Bullen, 1898), 173, 179. Originally published in the *Pall Mall Gazette* (September 25, 1894).
63. Wells, *Certain Personal Matters*, 170. Internally dated 1897.
64. H. G. Wells, *Seven Famous Novels* (New York: Knopf, 1934), 771.
65. H. G. Wells, *The Undying Fire: A Contemporary Novel* (London: Cassell, 1919), 215–216. Wells makes a point of this passage in his *Experiment in Autobiography* (London: Gollancz, 1934), 2:676.
66. For my account of Adams and especially *The Education*, see “Between Two Fires: Henry Adams and the Temperature of History,” in *Nature, Politics, and the Arts: Essays on Romantic Culture for Carl Woodring*, ed. Hermione de Almeida (Newark: University of Delaware Press, 2015), 249–263.
67. The OED reports an isolated use in 1851 but notes that the term science fiction did not enter common use before the end of the 1920s.
68. Jules Michelet, *Histoire du dix-neuvième siècle*, t. 3, *Jusqu'à Waterloo*, in *Oeuvres complètes* (Paris: Flammarion, 1898), 110. The “terrible preoccupation with famine” that Michelet sees in both works—Malthus's published and Grainville's apparently begun in 1798—he attributes to “the terror produced towards the end of the eighteenth century by the apparent exhaustion of the earth,” furthered in the experience of hunger, scarcity, grain riots, and starvation



before and during the French Revolution.

69. Jean-Baptiste Cousin de Grainville, *The Last Man, or Omegarus and Syderia, a Romance in Futurity*, 2 vols. (London: R. Dutton, 1806), 1:21.
70. An earlier and more direct expression of the lived-through end of the world was the spectacular melodrama *Le jugement dernier des rois* (1793), whose culminating volcanic explosion finishes off the whole gallery of quarrelling European kings and the remote island of their exile. However, that hopeful inaugural event is far removed in feeling from the terminal suicide of the Earth Spirit or that of mankind in Omegarus's grand refusal. Grainville himself committed suicide in February 1805, before publication.
71. Camille Flammarion, *Omega: The Last Days of the World* (New York: Cosmopolitan, 1894). The translator is identified, in a list of authorized translations found in the French editions, as Arthur Sherburne Hardy. Initial publication was in *Cosmopolitan* 14 and 15, beginning April 1893.
72. Camille Flammarion, *La fin du monde* (Paris: Ernest Flammarion, 1894), 48. Translations are mine unless otherwise indicated.
73. The American version provides a pensive figure before the Sphinx, as in Ingres's *Oedipus*, but carrying a heavy tome and contemplating the inscription, where, however, the "equals" sign is rendered as a dash.
74. In responding to the request for a brief autobiography from a medical society in 1899, Chekhov credited his study of the medical sciences with an important influence on his literary work, and continued: "My acquaintance with the natural sciences and with the scientific method has always kept me on my guard, and I have tried wherever possible to take the scientific data into consideration; and wherever that was impossible I have preferred not to write at all" (from "Tchekhov's Autobiography," in *Plays and Stories, Everyman's Library* [London: Dent, 1937], [ix]).
75. From the generally close translation of Elisaveta Fen, in *Plays by Anton Chekhov* (Harmondsworth: Penguin, 1959), 212, 222, 223.
76. W. H. Bruford, *Chekhov and His Russia: A Sociological Study* (London, 1947), 39.
77. Anton Chekhov, *The Wood Demon* (3.6), trans. S. S. Kotliansky, in *Plays and Stories*, 147.
78. Chekhov, *Plays*, trans. Fen, 128–130.
79. Anton Chekhov, *The Chorus Girl and Other Stories*, trans. Constance Garnett (London: Chatto and Windus, 1920), 237–252.
80. Nordau credits B.-A. Morel's *Traité des dégénérescences physiques, intellectuelles et morales de l'espèce humaine* (1857) and especially the writings of Cesare Lombroso, to whom he dedicates his book, for his method: "a really scientific criticism" based upon "psycho-physiological elements." See *Degeneration* (London: Heinemann, 1895), xvii.
81. Much later, in a 1930 revision, Lalande abandoned the term "dissolution" in favor of the still less arresting "involution." See Colin Smith, *Contemporary French Philosophy* (London: Methuen, 1964), esp. 101–105, for an account that locates Lalande in relation to central themes in French moral philosophy up to the time of writing.
82. André Lalande, *La dissolution* (Paris: Félix Alcan, 1899), 446.
83. Arthur Symons, "The Decadent Movement in Literature," *Harper's New Monthly Magazine* 87 (European ed.; November 1893): 858–859 (vol. 26, American ed.). Without letting on, Symons draws many of his generalizations from Théophile Gautier's assertive, defining account of "the style of decadence" in his preface to Baudelaire's *Fleurs du mal*.
84. Nordau, *Degeneration* (London: Heinemann, 1895), 494–500. Earlier, Nordau had achieved considerable fame with his radical attack on nineteenth-century institutions, *The Conventional Lies of Our Civilization* (1883; Chicago: L. Schick, 1887), where he lays the sickness of the age at the door of the discrepancy between our scientific understanding and the obsolescence of our social arrangements and official pieties. Both books are in fact attacks on philosophic pessimism, and he projects a healthier future after the current crisis passes, through the workings of evolutionary mechanisms. "For the future of humanity is elevation and not degradation [Erniedrigung]" (Lies, 359). Meanwhile, he describes a civilized world succumbing to sheer nervous exhaustion, fostering degeneracy, hysteria, and neurosis, the consequences of "excessive organic wear and tear" (*Degeneration*, 43).
85. Michel Serres, *Feux et signaux de brume: Zola* (Paris: Grasset, 1975).
86. Zola's preface, dated July 1, 1871, appeared at the head of the first "episode," *La fortune des Rougon*; in *Émile Zola, Oeuvres complètes*, ed. Henri Mitterand (Paris: Cercle du Livre Précieux, 1967), 2:19 (my translations unless otherwise indicated).
87. Zola, *Oeuvres complètes*, 2:387.
88. F. W. J. Hemmings, *Émile Zola*, 2nd ed. (Oxford: Clarendon, 1966), 92; Zola, *Oeuvres complètes*, 2:448–449.
89. Zola, *Oeuvres complètes*, 4:347–348.
90. Some translations misconstrue this piece of applied folklore and have Nana "churning" the milk rather than souring it.
91. Zola, *Oeuvres complètes*, 6:691.
92. L. W. Tancock translates this as "the physical laws governing the world." The phrase is "la loi des forces qui mènent le monde" (*Émile Zola, The Debacle*, trans. L. W. Tancock [Harmondsworth: Penguin, 1972], 73).

93. See Zola's subsequent "Sur la Guerre" (1899) for a considered statement on war, where he condemns its wasteful inutility for the furtherance of civilization (*Oeuvres complètes*, 14:844–854). Zola is prescient about the next great war but not about its lessons making for an irenic aftermath.
94. For a plausible explanation of the changed final shape of Zola's cycle, linking it to his personal renewal (notably with the advent of Jeanne Rozerot), see Hemmings, *Émile Zola*, 256–259. The issue of fertility, one of much concern at the time in the context of the competition between nations and races, would be made central in Zola's subsequent novel, *Fécondité* (1899).
95. Henry Adams, *The Degradation of the Democratic Dogma* (New York: Macmillan, 1919), 252.
96. Adams, *Degradation*, 241–242.
97. Jean Brunhes, *La Géographie humaine: essai de classification positive, principes et exemples* (Paris: Félix Alcan, 1910), 429–435. Jean adopts the German term, which he explains as "rapine économique" or, more simply, "dévastation" (409–410). For his survey of such devastations, accomplished and ongoing, see 409–513.
98. Bernard Brunhes and his brothers were active in the social Catholicism that took its brief from Leo XIII's great encyclical *Rerum Novarum* (1891). See *The Dictionary of Scientific Biography*, s.v. "Jean Brunhes." On the disparity in popular knowledge between the two physical laws, Brunhes cites Rankine's "On the Want of Popular Illustration of the Second Law of Thermodynamics" (1867; in *Miscellaneous Scientific Papers* [London, 1881]) and his own more recent documentation of the neglect of the second law in French scientific writing and general knowledge, in *Petit de Julleville's Histoire de la langue et de la littérature française* (1899).
99. Bernard Brunhes, *La dégradation de l'énergie* (Paris: Flammarion, 1908), 29. If one were to follow Hawking on radiation from black holes—the latter unknown of course to Brunhes—the ultimate high entropy state would entail not "no radiation" but "all radiation."
100. Anticipations, framed in terms of "waste," are to be found by implication in Kelvin's initial formulations, as read by Crosbie Smith (*The Science of Energy*, 110–111). The Brunhes legacy passes through the work *Wealth, Virtual Wealth, and Debt* (1926), of Frederick Soddy, Nobel chemist, recently rediscovered; and Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, Mass.: Harvard University Press, 1971). See Linda Merricks, *The World Made New: Frederick Soddy, Science, Politics, and Environment* (Oxford: Oxford University Press, 1996); and Eric Zencey, "Mr. Soddy's Ecological Economy," *New York Times*, April 12, 2009.
101. Gerald Holton, *Thematic Origins of Scientific Thought* (Cambridge, Mass.: Harvard University Press, 1976), 95–96; from an essay, "Science and New Styles of Thought," originally published in 1967.
102. Karl Kroeber, "The Evolution of Literary Study, 1883–1983," *PMLA* 99 (May 1984): 334.
103. For an account of the early Picasso that finds the literal—that is, political—anarchism in his art, see Patricia Leighton's *Re-Ordering the Universe: Picasso and Anarchism, 1897–1914* (Princeton, N.J.: Princeton University Press, 1989).
104. Oswald Spengler, *The Decline of the West*, 2 vols. in 1 (1918, 1922), trans. C. F. Atkinson (New York: Knopf, 1932), "Introduction," 25–26. Spengler claims to have drafted the first volume before 1914 and reworked it in 1917.
105. Gillian Beer, *Open Fields: Science in Cultural Encounter* (Oxford: Clarendon, 1996), 298.
106. For a clear (brief) discussion of Schrödinger's "burlesque case," see Walter Moore, *Schrödinger: Life and Thought* (Cambridge: Cambridge University Press, 1989), 306–309.
107. Jean-Paul Sartre, "On the Sound and the Fury: Time in the Work of Faulkner," in *Literary and Philosophical Essays*, trans. Anne Michelson (London: Rider, 1955); reprinted in *Faulkner: A Collection of Critical Essays*, ed. Robert Penn Warren (Prentice Hall, 1972), 87.
108. William Faulkner, *The Sound and the Fury and As I Lay Dying* (New York: Modern Library, 1946), 192.
109. James Thomson, "The City of Dreadful Night," sec. 2, ll. 32–36.
110. Thomas Pynchon, *The Crying of Lot 49* (London: Jonathan Cape, 1967), 129.
111. See also Pynchon, "Entropy," in *Slow Learner: Early Stories* (London: Jonathan Cape, 1985). In the introduction, he notes that he had been reading Henry Adams's *Education* and Norbert Wiener's *Human Uses of Human Beings* at the time of the writing, and "Adams's sense of power out of control, coupled with Wiener's spectacle of universal heat-death and mathematical stillness, seemed just the ticket."
112. Yevgeny Ivanovich Zamyatin, *We*, trans. Bernard Guilbert Guerney (Harmondsworth: Penguin, 1970). Quotations for the most part follow Guerney, but for convenience references are according to "entry" in the record kept by D-503.
113. Zamyatin quotes from *The Undying Fire* in his essay "Paradise" (1921), a critique of the Bolsheviks' drive—in this postrevolutionary "cosmic era"—toward a "monophonic universe." In "Paradise" and again in his comprehensive essay on "H. G. Wells," he quotes the declaration of Wells's Satan, in dialogue with God (echoing Job and Goethe's Faust), "Yes, without me time and space would freeze into crystalline perfection.... It is I who trouble the waters. I trouble all things. I am the spirit of life." See Yevgeny Ivanovich Zamyatin, *A Soviet Heretic: Essays by Yevgeny Zamyatin*, ed. and trans. Mirra Ginsburg (Chicago: University of Chicago Press, 1970), 67, 278.
114. Zamyatin, *A Soviet Heretic*, 107–108.

115. Arkady Strugatsky and Boris Strugatsky, *Definitely Maybe: A Manuscript Discovered Under Unusual Circumstances*, translation of *Za milliard let do kontsa sveta* by Antonina W. Bouis (New York: Macmillan, 1978).
116. David H. Helsa, *The Shape of Chaos: An Interpretation of the Art of Samuel Beckett* (Minneapolis: University of Minnesota Press, 1971); J. E. Dearlove, *Accommodating the Chaos: Samuel Beckett's Non-Relational Art* (Durham, N.C.: Duke University Press, 1982); Raymond Federman, *Journey to Chaos: Samuel Beckett's Early Fiction* (Berkeley: University of California Press, 1965).
117. Beckett, quoted by Alec Reid in *All I Can Manage, More Than I Could: An Approach to the Plays of Samuel Beckett* (Dublin: Dolmen, 1968), 68.
118. Letter to George Reavey, September 27, 1938, in *The Letters of Samuel Beckett*, vol. 1: 1929–1940, ed. Martha Dow Fehsenfeld et al. (Cambridge: Cambridge University Press, 2009), 643. Cf. Ionesco's discovery of the seeds of his masterpiece of chaotic antilogic, *La cantatrice chauve*, in a teach-yourself manual for English.
119. See James Knowlson, *Damned to Fame: The Life of Samuel Beckett* (New York: Simon & Schuster, 1996), 57.
120. Samuel Beckett, *Proust* (New York: Grove, 1954), 71–72; Arthur Schopenhauer, *Die Welt als Wille und Vorstellung*, in *Werke in zehn Banden*, Züricher Ausgabe (Zurich, 1977), 1:331. The key phrase in Schopenhauer's characterization is "so ganz verständlich und doch so unerklärlich," and he goes on to name, as symptomatic of the richness and depth of the language of music, its Segno and repeat signs (*Repetitionszeichen*) and the *Da Capo*. In his treatise, Beckett calls attention to Schopenhauer's formative influence on Proust's musical aesthetics as well as to the philosopher's rejection of Leibniz's characterization of music as "occult arithmetic."
121. Samuel Beckett: An Exhibition Held at Reading University Library, May to July 1971, comp. James Knowlson (London: Turret, 1971), item 277 (letter of March 9, 1964). The fascination of the repeating decimal, ever lessening in extension, had struck one of Beckett's Victorian predecessors in the art of giving shape and voice to meaninglessness. In James Thomson's despairing "City of Dreadful Night," the wandering speaker follows a pedestrian, who seems to walk with purpose, to the places where Faith, Love, and Hope had died, only to come back to where he started, to begin the same endless round:

He circled thus for ever tracing out  
The series of the fraction left of Life;  
Perpetual recurrence in the scope  
Of but three terms, dead Faith, dead Love, dead Hope.

Thomson here supplies a footnote: "Life divided by that persistent three =  $\frac{LXX}{333} = .210$ ." That is, a blighted three score

and ten is reduced in the perpetual iteration of despair to an ever-dwindling decimal fraction: .210210210+. See "The City of Dreadful Night," sec. 2, ll. 45–48, in *Poems and Some Letters of James Thomson*, ed. Anne Ridler (London: Centaur, 1963), 181. The likelihood of Beckett's having read Thomson in his earlier years is considerable, and this particular poem of spiritual darkness and modern acedia invokes a fistful of themes whereon Beckett casts his colder eye.

122. Hugh Kenner, in the *New York Times Book Review* (December 18, 1983): 9, 22. In 1946 (two years before writing *Godot*), Beckett gave his brother Gerald an inscribed copy of Erwin Schrödinger's *What Is Life?*, with a chapter featuring "Order, Disorder, and Entropy." Schrödinger there writes, "In a word, everything that is going on in Nature means an increase of the entropy of the part of the world where it is going on. Thus a living organism continually increases its entropy...and thus tends to approach the dangerous state of maximum entropy, which is death" (*Samuel Beckett: An Exhibition*, item 108).
123. Aristotle's elaborations of *mythos*, the term we translate as "plot."
124. *Grove's Dictionary of Music and Musicians* (London, 1954), vol. 3, s.v. "Form."
125. Ruby Cohn, *Just Play: Beckett's Theater* (Princeton, N.J.: Princeton University Press, 1980), 120.
126. Condensed from Lucky's learned aria in *Waiting for Godot: Tragicomedy in Two Acts* (New York: Grove, 1954), ff. 28–29. This text, Beckett's translation from the original French, furnishes all direct quotations. For a revised English text that incorporates modifications largely made in production and subsequently endorsed by Beckett himself, see *Waiting for Godot*, ed. Dougald McMillan and James Knowlson, in *The Theatrical Notebooks of Samuel Beckett*, vol. 1 (London: Faber and Faber, 1993).
127. The phrase "one day like any other day" was omitted inadvertently in the American Grove editions.
128. Arthur Schopenhauer, "On Death, etc.," in *The World as Will and Idea*, additions to book 4, chap. 41.
129. Samuel Beckett, *Endgame: A Play in One Act* (New York: Grove, 1958), 1. The trope returns later in the play, in Hamm's reflections, where it is credited to "that old Greek." For the likely candidates, see the *Theatrical Notebooks*, 2:46–48.
130. Gontarski, in the *Theatrical Notebooks*, 2:43, refers to a typescript called "Avant Fin de partie" with such localizing suggestions.

131. "Shelter" in the American edition, "refuge" in the British edition; "le refuge" in the original French. Possibly germane are the ruined German coastal emplacements in Normandy from World War II, in at least one case (Gatteville-le-Phare) converted to a dwelling.
132. See Rosemary Poultney, *Theatre of Shadows: Samuel Beckett's Drama* (Gerard's Cross: Colin Smythe, 1988), 149.
133. The title of the exhibition catalogue essay by Yve-Alain Bois in *Ad Reinhardt* (New York: Rizzoli, 1991), 11–33.
134. Letter of January 14, 1911, quoted in Arnold Schoenberg and Wassily Kandinsky: *Letters, Pictures, and Documents*, ed. Jelena Hahl-Koch, trans. John C. Crawford (London: Faber & Faber, 1984), 136. The Munich program consisted of Schoenberg's *Second String Quartet*, Opus 10, and the three piano pieces of Opus 11, the music with which he found his way to "atonalism," though still a long way from his articulation of twelve-tone serialism.
135. Harry White, "'Something Is Taking Its Course': Dramatic Exactitude and the Paradigm of Serialism in Samuel Beckett," in *Samuel Beckett and Music*, ed. Mary Bryden (Oxford: Clarendon, 1998), 163.
136. Peter Szendy's characterization of the structural figure that dominates Beckett's *Come and Go* and *Time Passes*. See "End Games," in *Beckett and Music*, 127.
137. Cf. J. M. Coetzee, "Samuel Beckett's *Lessness*: An Exercise in Decomposition," *Computers and the Humanities* 7 (March 1973): 195–198.
138. White, "Something Is Taking Its Course," 162.
139. Rosalind E. Krauss, "LeWitt in Progress," in *The Originality of the Avant-Garde and Other Modernist Myths* (Cambridge, Mass.: MIT Press, 1985), 244–258. LeWitt says he read Beckett and Robbe-Grillet in the late 1950s and 1960s and that the objectivity, terseness, and "the certain kind of logic involved" must have influenced him theoretically (reported in Jeremy Lawson's catalogue essay for *Sol Lewitt: Prints 1970–86* [London: Tate Gallery, 1986], 10). Krauss reproduces LeWitt's drawing of modular blocks framing text for a *Harper's Bazaar* publication of Beckett's *Come and Go* (April 1969).
140. Eric Salzman, "Imaginary Landscaper" (1982), in *Writings About John Cage*, ed. Richard Kostelanetz (Ann Arbor: University of Michigan Press, 1993), 4.
141. John Cage, *Silence* (London: Calder and Boyars, 1968), 195.

## 8. CODA, OR DA CAPO AL FINE

1. John E. Bowlit, "The Old New Wave," *New York Review of Books* 31 (February 16, 1984): p. 27.
2. Kasimir Malevich, *The Non-Objective World*, trans. Howard Dearstyne (Chicago: Paul Theobald, 1959), 20, 67, 76.
  3. Robert Chandler, however, dismissing the aspirational declarations of Malevich and his colleagues as "counterintuitive," reads the Black Square as a symbol of mourning and an expression of despair. "It is a direct response to World War I" (*New York Review of Books* [October 9, 2014]: 20).
4. Quoted in the *Grove Dictionary of Art*, ed. Jane Turner, vol. 26 (New York: Grove, 1996), s.v. "Reinhardt." John Milner suggests that Malevich, who frequently claimed that his Black Square dated from 1913, was justified if one takes into account its use on costume and backdrop in the famous Futurist collaboration *Victory Over the Sun* (John Milner, *Kazimir Malevich and the Art of Geometry* [New Haven, Conn.: Yale University Press, 1996], 95).
5. Yve-Alain Bois, "The Limit of Almost," in *Ad Reinhardt*, exhibition catalogue (New York: Rizzoli, 1991), 29, quoting from *Art-as-Art: The Selected Writings of Ad Reinhardt*, ed. Barbara Rose (New York: Viking, 1975), 109.
6. Bois, "The Limit of Almost," 28, quoting Reinhardt, *Art-as-Art*, 73.
  7. It had a focal place in the 1915–1916 exhibition. See the photograph of a corner and two walls in Milner, *Kazimir Malevich*, 121, and further remarks and illustrations of later work (132–135).
8. Barbara Novak and Brian O'Doherty, "Rothko's Dark Paintings: Tragedy and Void," in *Mark Rothko*, National Gallery of Art, Washington (New Haven, Conn.: Yale University Press, 1998), 278.
9. Rothko to Robert Motherwell, cited in Jeffrey Weiss, "Rothko's Unknown Space," in *Mark Rothko*, National Gallery of Art, Washington, 326.
10. Novak and O'Doherty, "Rothko's Dark Paintings," 280. The authors provide a welcome caveat in speaking of the Rothko Chapel paintings and the so-called Seagram murals at the Tate: "The drama of these works, if present, is frugal, tentative, and approaches the contemplative fallacy: at a certain threshold of perception, virtually any blankness (or blackness), given an appropriately solemn context, may return to the watcher self-generated illusions that he or she mistakes for profundities." They describe it as "a function of effect over evidence" (270–271).
11. The thesis of a continuity with Friedrich and his like was notably argued in Robert Rosenblum, *Modern Painting and the Northern Romantic Tradition: Friedrich to Rothko* (New York, 1975), a development of his earlier essay "The Abstract Sublime" (1961). The affinities between Turner and modern abstract expressionism was the theme of a memorable exhibit of late Turner paintings and "color beginnings" at the Museum of Modern Art and of Lawrence Gowing's catalogue essay, *Turner: Imagination and Reality* (New York: Museum of Modern Art, 1966). It was there that

Rothko was “particularly taken” with the two Deluge paintings.

12. For Rothko’s earlier black-on-black or dark-on-dark paintings, see David Anfam’s monumental catalogue raisonné *Mark Rothko: The Works on Canvas* (New Haven, Conn.: Yale University Press; Washington, D.C.: National Gallery of Art, 1998), e.g., the series #773 to #781 (1964).
13. Jan Kott, *Shakespeare Our Contemporary*, trans. Boleslaw Taborski (London: Methuen, 1964), preface by Peter Brook. Brook produced the play, later adapted as a film, in 1962.



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